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CONVERSATION AND LEXICAL STRUCTURE

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ABSTRACT

To ascertain what a word contributes to the conveyed import of an utterance in which it occurs, participants in conversation have recourse to two species of reasoning. The first mode of reasoning operates on the syntactic and semantic structures of the language via semantic rules · such reasoning is called **inference**. *The second mode of reasoning arises from pragmatic principles governing the cooperative use of language by participants in discourse : this variety of reasoning is known as* **conversational implicature**. *What we conversationally implicate arises not only from what we choose to say but also from what we might have said, but chose not to say. By identifying what aspects of an utterance's conveyed import are due to pragmatic principles and what aspects are due to semantic rules, we can decide upon what aspects are due to semantic rules, we can decide upon what aspects of meaning are to be incorporated into the dictionary entry of a word and discover how words are arrayed relative to each other in the dictionary. Three examples are discussed :* **go** *and* **come** ; **climb** *and* **ascend** ; **promise** *and* **expect**.

What a word contributes to the conveyed import of an utterance depends not only on its conventional content but also on aspects of its use in discourse. When participants in conversation hear a word uttered in the speech-stream what facets of its conveyed import do they attribute to its meaning and what facets do they ascribe to their knowledge of how pragmatic principles govern the use of language? I will attempt to make explicit the varied roles a word can play in lexical inference and in Conversational Implicature (Grice 1968, 1975).

When we speak, we act. We perform *speech-acts* to convey our intentions and desires : our use of language is purposive. At one and the same time we speak informatively : the content of what we say is meaningful. We communicate both what we intend and what we mean by means of formal, grammatical systems. Participants in conversation perceive and comprehend the content of what is said and the intentions that stand behind it without separating the two.

The parties to a conversation do more than trade semantic representations with one another : they interpret and act on them. To prepare to carry out these plans, they build mental pictures representing the events, actions, objects, relations, etc. that make up the content of what is said. They draw these elements of the picture from at least three different sources : (i) the logical structure of what is said ; (ii) what is needed to insure that the picture will be coherent (Rescher 1964) ; and (iii) what additional information is required to preserve the assumption that all parties to the discourse are observing *Co-operative Principle* (Grice 1975). In order to arrive at a clear global picture certain elements from each of the three stockpiles may have to be added to or deleted from the mental picture.

The Co-operative Principle is a model of rational behavior that attributes to participants in conversation purposeful intentions whenever they engage in a talk-exchange. This principle enjoins you to

> "make your conversational contribution such as is required, at the stage it occurs, by the accepted purpose and direction of the talk exchange in which you are engaged (Grice 1975 : 43)."

Grice proposes four dimensions of cooperation adherence to which secures the uptake of the Co-operative Principle. He expresses them in the form of Maxims. *Quality* : what you say should be true and you should have adequate grounds for holding it to be true. *Quantity* : you should say neither more nor less than is appropriate for the purpose at hand. *Relation* : what you say should be relevant to the purpose at hand. *Manner* : be perspicuous (adapted from McCawley, to appear b). Clearly, other pragmatic

dimensions can enter into conversation. *Effort*: make the amount of effort you take in producing an utterance commensurate with the amount of effort you expect your addressee to supply in interpreting it. *Tailoring*: what you say should be framed in such a way so as to facilitate a response to it. What the speaker indicates to his addressee to add to or subtract from the mental picture on the assumption of mutual compliance with the Co-operative Principle are called *conversational implicata*. The relations between what is said and what is implicated are *conversational implicatures*. These relations are psychological bridges between what a speaker says and what his intentions are in speaking. The speaker may indicate the presence of an implicature by exploiting, flouting, or opting out of one or more of the conversational maxims (Grice 1975).

Upon the assumption that the conversation in which they are engaged meets the dimensions of cooperativity, the participants are entitled to assume that their talk-exchange is taking place in the "least marked situation" (see McCawley, to appear a). The logical content of what is said serves as the basic source for the objects and relations that go into the mental picture: the objects, events, relations, etc. expressed in the semantic structure are translated into that picture without great to do. Patchwork based upon information present in the situation where the talk-exchange takes place or upon shared background knowledge often accompany the translation. Deviation from the least marked situation underscores the need for conversational implicature to rectify the mental picture representing the content of what is said. Even so, conversational implicature may be deployed when the deviation is not apparent.

To build up this mental picture, the participants must anchor themselves relative to the content of what is said. They achieve this orientation by establishing relations among the elements of the mental picture, between themselves, and between the talk-exchange they are engaged in and the content of what is said. These connections may be perceptual (see Steever 1977), spatial, temporal (see Smith 1977), causal (see McCawley, to appear a), etc. What guidelines are followed in setting up such relations? Grice (1975: 57) suggests that "the specification of closeness or remoteness of the connection between a person and object and a further person who is mentioned or indicated should be likely to be of interest." Grice continues to suggest why this should be so: "The answer must lie in the following region: transactions between a person or thing closely connected with him are liable to be very different as regards their concomitants and results from the same sort of transactions involving only remotely connected persons and things." If the speaker engages one addressee in a talk-exchange over another it is because that transaction more directly involves the addressee he has singled out than any other. To do otherwise would contravene the Co-operative Principle.

What a word contributes to the semantic structure of a sentence in which it appears depends on what logical elements and configurations it encodes. Words contain the same sorts of categorial information, constituent structure, and semantic primes as are found in logical and syntactic structures (see specially Gruber 1976). This underlying parity of lexical and logical structures allows grammarians the opportunity to employ the same tools of investigation and analysis in both domains. McCawley (1971) argues that rules of word-formation are subject to the Ross Constraints on Movement Rules (Ross 1967): the configurations of semantic material that these rules prohibit may appear neither in syntactic nor in lexical structures. Consider the following pairs of sentences:

(1) a Bill kissed Susan and someone else.
b *Who else did Bill kiss Susan and?

(2) a Benedetto carves granite and marble.
b *Benedetto slimps marble Where *slimp* = *carve granite and*.

Both the starred sentences, McCawley contends, exhibit the same grammatical anomaly, namely a violation of the Co-ordinate Structure Constraint. Gruber (1976) offers arguments for lexical decomposition based on argument forms usually associated with syntactic investigation: co-occurrence restrictions, paraphrase relations, strict subcategorization, and the like. Postal (1970) puts forth extensive evidence for the lexical decomposition of *remind* as *STRIKE (LIKE)*. Notice that the following sentences display the same anomaly, namely coreference between the underlying subject and direct object.

(3) a Joe reminded me of Scott Fitzgerald.
b *Joe reminded me of himself

(4) a It struck me that Joe was like Scott Fitzgerald.
b *It struck me that Joe was like himself.

Such similarities lead us to conclude that no principled distinction between syntactic and lexical structures exists as far as their contribution to semantic structure goes. Further, this brings with it the consequence that lexical decompositions do not differ from transformations.

Carnap (1947) introduced the device of meaning postulates to express the variety of semantic relations that may hold between words: synonymy, antynomy, equivalence, entailment, ambiguity, and their ilk. Meaning postulates - what a generative grammarian calls lexical decompositions - broaden the scope of logical inference and, hence, of practical reasoning. They make explicit what semantic conclusions a speaker may draw from the content of lexical items. Johnson-Laird (1976 : 9) points out :

> "Perhaps the most obvious sort of inference... involves simple relations between such lexical items as nouns, verbs, adjectives, etc. The meaning of words are, of course, often interrelated, and a speaker's knowledge of such interrelations acts very much as a smoothing oil to help the inferential machinery revolve... Logicians have tended to ignore this aspect of practical reasoning although the device of meaning postulates (see Carnap and Bar-Hillel) was developed to deal with the logical consequences of the semantic relations between words."

Decomposition of a lexical item into its primitive semantic constituents allows participants in conversation to draw certain consequences from the word's content, as specified by its particular meaning postulate. If participants in conversation use the word *kill* in a talk-exchange, they are entitled to disengage from it via its meaning postulate a variety of semantic information and to construct their mental pictures of the content of the discourse accordingly. *kill = CAUSE (X, BECOME (NOT (ALIVE, Y)))*. The participants are then at liberty to inquire whose death is in question, what event brought the death about, what circumstances surround it, etc. Lexical inference serves as a bridge from what is said to the mental pictures representing its content, for as Johnson-Laird (1976 : 12) notes : "The most likely way in which such an inference is made involves setting up an internal representation of the scene depicted by the premises." We arrive at the conclusion that the operations performed by lexical decompositions, rules of inference, and transformations cover the same range of deduction and inference.

Inference in its various guises belongs to the explicit characterization of a participant's knowledge of the structure of the language he uses and of what he may deduce from linguistic communication on the basis of its logico-grammatical form.

I wish to contrast inference with another means of arriving at conclusions concerning the content of what is said in a talk-exchange : *Conversational Implicature.* This is a mental operation that a participant performs to relate an implicatum to the context in which an utterance occurs. We can express several pragmatic relations between an utterance along with its context and the implicatum that issues from exploitation of the Cooperative Principle : variability, calculability, cancellability, reinforcability, and non-detachability. It may be that inference is a sub-species of conversational implicature in that both share the criterion of non-detachability : while it is a sufficient condition for inference it is only necessary for implicature. Other differences exist to be sure. A rule of thumb may be given : what is semantic arise in virtue of the formal, conventional content of what is uttered and what is pragmatic issues from the intention to use language to communicate.

When participants in conversation draw conclusions about a word's conveyed import, which do they make in virtue of the system of conventional logico grammatical rules and which in virtue of Conversational Implicature ? We may approach these questions by examing the various properties a word exhibits : are they indicative of a semantic or a pragmatic origin ? If a word exhibits two "senses" in conversation, is the word "ambiguous" or "variable"? If we answer along the lines of the first response, then we are making the claim that the word invariably has two senses embedded in the conventional grammatical system ; if the second, that one of the senses arise via pragmatic calculation.

Such questions and their answers ought to lead us to decide what facets of word's conveyed import are to be registered in its logical structure. Further, we should begin to discern how words are related to one another in the lexicon. What the actual lexicon cantains will indicate what we may conversationally implicate. It will also tell us when we may exploit true ambiguities (see Weiser 1974). McCawley (to appear a) argues that in the pragmatic exploitation of the

Co-operative Principle what we conversationally implicate depends not only on what we say but also on what we might have said but did not. We will now go on to examine three cases in which this principle is deployed.

Come and go

The question of how lexical items incorporate deictic categories is of particular interest : as noted above, participants in conversation must anchor themselves relative to one another and to the content of what they talk about. Deixis is a central means for carrying out this task. *Come* and *go*- at least in cloak-room discussions - are treated as deictically antynomous. It is held that *come* encodes TRAVEL (TO, X) and that *go* encodes TRAVEL (FROM, X). Here X stands for a deictic pivot. Gruber (1976 : 298) suggests that

> "..... *come* takes a deictic category that refers to the place of any person mentioned in a sentence in which the sentence with *come* is embedded whereas *go* will take the deictic category referring to the place of any other person or thing."

Gruber (1976 : 299) claims that the deictic category for *go* is the more general of the two and that it must be negatively defined with respect to *come*. I wish to make the claim that of the two verbs *come* alone contains deictic information in its conven tional structure whereas *go* contains none. The opposition between the pair is privative rather than equipollent or gradual. I will argue that *go* simply encodes TRAVEL in its semantic structure; the direction and, perhaps, the path are conversationally implicated.

Under this hypothesis, *come* contains more conventional material than *go*. The dimension of Quantity will dominate the calculation of the conversational implicature. Should a speaker use *go* instead of *come*, his addressee is entitled to reason that the speaker is not in an evidential position to vouch for the extra information that *come* contains. Consider sentences (5) a and (5) b :

(5) a John went to the meeting.
b John came to the meeting.

When the speaker utters (5) b he is apt to convey more information than if he uttered (5) a : that he himself was at the meeting to which John went or that he was involved in the planning of that meeting in some way. I conjecture that in order to insure co-operativity the speaker must provide his addressee with as much information as he believes will bear on the speech-event or on the content of what is being discussed in that event. We already recorded reasons why the closeness or remoteness of a relation between a person and thing and a further person mentioned in a talk-exchange (see page 2). If *come* contains information pertaining to the speech-event, namely that one endpoint of the motion is anchored relative to the speech-event, the speaker is obliged to use *come* if he is in a position to do so (see McCawley, to appear a, for a similar discussion about transitive versus intransitive *open*).

The calculation of the implicature relating the semantic structure of *go* to the implicatum FROM X arises through the speaker's being able to choose from among *come*, *go*, etc. and his exploitation of the Maxim of Quantity. The speaker utters (5) a and his addressee maps that into mental picture of what is being talked about : TRAVEL (X). If the context so warrants him, he may further reason that the speaker was not in a position to utter (5) b, for the rules of sportsmanly behavior would have required him to supply that extra information if, indeed, he was in possession of it. The addressee concludes : NOT (TRAVEL (TO Y)) and adds that to his mental picture. However, on the face of it all, the two propositions form a contradiction, namely AND (TRAVEL X,) NOT (TRAVEL X.) The addressee then has to alter this proposition in order to make it co-operative (contradictions are not helpful) and, accordingly alters the implicature by associating the NOT with the directional predicate TO rather than the motional predicate TRAVEL (see Rescher 1964:24 about guidelines on how to alter propositions to make them coherent). NOT TO is equivalent to FROM (see Gruber 1976). The resulting picture contains the proposition TRAVEL X (FROM Y). The direction need not, under this analysis, be diametrically opposed to the direction indicated by *to*; if context so warrants, the direction may be tangential. However, if geometric and perceptual complexity coincide, the implicatum TRAVEL X. (TANGENTIAL Y) will be more complex than the implicatum TRAVEL X, NOT (TO Y) requiring more effort from both the speaker and the addressee and a more specific context. Further

more, if such complex deictic relations were important to the construction of the mental picture, the speaker would be required to choose a verb from a set that encodes more information, e.g. *cross, pass by,* or *traverse.*

The shred of evidence I have for considering *go* to be unspecified for a linear path is contained in (6).

(6) The beer spilled out of the keg and { spread / went / * came } all over.

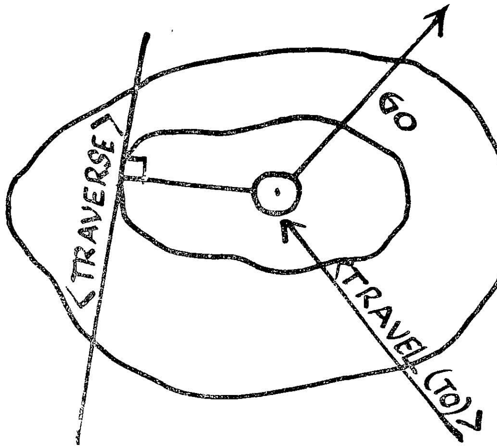
Even if the speaker of (6) was in a position where the spilled beer was moving towards him, he could not use *come* because of the specification of direction *all over* which conflicts with *come* but harmonizes with *spread* or *go.*

On the supposition that *go* is less informative than *come,* we may expect that *go* will appear in grammatical contexts that neutralize deictic distinctions. Consider (7).

(7) a Wherever he { goes / * comes } I always miss him.

b Whenever he { goes / comes } , I always see him.

In (7) a the distributive pronoun *wherever* neutralizes deictic categories and *go* appears in the frame. A speaker may utter (7) a and consistently report a number of occasions for some of which the referent in question approached the present speaker others of which he did not. The reason that *come* and *go* are considered as a pair is that they both share identical sub trees representing a core of meaning : TRAVEL X. If *go* encoded deictic information, it would be hard to explain why in some cases the direction indicated is FROM, in others TANGENTIAL, and yet in others no direction at all. Why, then, would *go* and not *come* appear in sentences such as (7) a? Once again, for reasons suggested on page 2, a



lexical item that encodes a shifter indicating towords the participants is more prized than one that does not.

The preceding style of argument may be repeated *ad voluntatem* for adjectives, adverbs, and nouns. Consider first degree adjectives :

(8) a John is { tall / short } .

b John is { taller / shorter } than Bill

c How { short / tall } is Mary?

d Arnold is as { tall / short } as Martha.

Suppose that *tall* means something like HAS HEIGHT. I would argue that *short* mean "less than average height". Use of *tall* in (8) a conveys "greater than average height" via the Maxim of Quantity and the existence of *short* in the lexicon. In (8)b through (d), *tall* shows up as the unmarked member of the opposition *short/tall.* The question (8)c when uttered with *short* presupposes that Mary is "less thanaverage height" whereas when uttered with *tall* it is neutral as to whether Mary is average height or whether she deviates from average (in either direction). Similarly for (8) d; when uttered with *tall*, the sentence is consistent with both Arnold and Martha being 4′ 8″ or 6′ 3″ while with *short*, the sentence is only consistent with a state of affairs in which both are 4′ 8″. Consider the same for adverbs and nouns in turn.

(9) a Mary ran {quickly / slowly}.

b Alex drank more {quickly / slowly} than Bill.

c How {quickly / slowly} did Marty dance?

d Phil hopscotched as {quickly / slowly} as Julie did.

(10) a Billy is of remarkable {height / ? shortness}.

b Suzie has a more remarkable {height / ? shortness} than Joanie.

c What sort of {height / ? shortness} does Victor have?

d Xavier's {height / ? shortness} exceeds that of his father

Quickly is the unmarked member of the pair *quickly* / *slowly* while *height* is the unmarked member of the pair *height* / *shortness* (see Horn 1976 for an insightful discussion of the correlation of semantic and morphological markedness). The sentences in (10) are all somewhat uncomfortable, owing to the avalability of a still more neutral term : *stature*. It is of interest that both in the case of the nouns and the adverbs, the derivational base is a degree adjective. I suggest that, in these cases, the multiplicity of "senses" arises through the operation of conversational implicature on a general, univocal lexical item via the Maxim of Quantity. *Go* is variable rather than polysemous and, as (7) a shows, the implicature is cancelable as well as calculable.[1]

Climb and Ascend

Let us turn now to the verbs *climb*, *ascend*, *climb up*, *descend*, and *climb down*. Whereas *come* and *go* involve the notion of shifters, this set of verbs involve directional adverbs.

Gruber (1976) used this set of verbs in paraphrase arguments to argue that words could incorporate semantic material indicating directionality, thus decomposing lexical items and establishing meaning postulates. Gruber advanced the claim that all the variants in (11) have the same prelexical structure

(11) Melvin {climbed / climbed up / ascended} the mountain.

Gruber claims that the three verbs that occur in (11) are synonyms of one another. I would claim that such a strong position cannot be maintained and that it must be replaced with a weaker one : namely, all three share identical sub-trees in their prelexical structure. Further, *climb* contains less conventional content than *climb up* or *ascend*. The latter two differ from one another in the types of manner adverbials they may cooccur with. *climb*, I will argue, is inspecified for direction; whenever its use conveys the direction UP, it is due to conversational implicature

Gruber asserts that *climb* optionally incorporates the directional adverb UP; that is, when *climb* appears on the surface without UP - or its surface manifestation *up* - that the directional adverb has been incorporated in the word *climb* without changing the meaning of CLIMB UP.

(12) a John climbed the ladder.

b John climbed up the ladder.

c John ascended the ladder.

However, if all the sentences of (12) are synonymous they should fare the same when any one undergoes a semantic anomaly such as contradiction. But this is not borne out in (13).

(13) a John climbed down the ladder.

b ? *John climbed up down the ladder.

c *John ascenced down the ladder.

If *climb* and *climb up* were entirely equivalent semantically both (13) a and (13) b should share the same grammaticallity judgement. Consider further a number of contexts in which (14) could be uttered.

(14) a Muggsy climbed the ladder to his death.

(14) could be uttered felicitously by a news reporter who was relating either of the following situation: Muggsy ran down an alley, he saw a ladder that led up to the top of an apartment building roof, he climbed it but as he put his hand over the edge a snake fancier's pet viper struck him and he died. The second scenario runs : Muggsy was chased up the stairs by the vice squad went out the door onto the roof, saw a fire ladder and started climbing down frantically. The ladder ended five stories above

street level, but Muggsy didn't notice and when the ladder ended, gravity took over. He plunged to his death on the pavement. Or Marshall Matt Dillon can stand atop the edge of Dry Gulch and felicitously utter (15).

(15) Black Bart climbed to his death in the ravine.

The direction indicated (implicated) in (15) is downwards. In uttering a sentence such as (16), one not only implicates that John made an ascent of the mountain, but that he also came backdown.

(16) Sir Hines climbed the peak.

Climb, describes an activity, and it described a motion along a vertical plane. It belongs in the same lexical field with *scale, mount*, etc. *scale* and *climb* are not specified for directionality, but rather for the difficulty with which the activity is carried out; some resistance against the vertical plane or some effort in execution (but *The temperature climbed steadily in the afternoon.*)

(17) Niels { ?scaled / ?climbed / ascended } the face of the cliff effortlessly.

Ascend does not require that there be resistence against a vertical plane or surface.

(18) He rose from the Dead and { ascended / ??climbed } into heaven / { ? scaled / ? rose / ? floated } up

Both *ascend* and *scale* generally require volition whereas *rise* does not.

A reasonable implicature that accounts for the attachment of UP to *climb* conversationally must be presented. Neither the dimensions of quality or quantity are clearly at stake here. Perhaps we may rely on the Maxim of Relation: what is said should be relevant to the goals of the conversation, and should be remarkable as well. Grice (1968: Lecture 1, page 21) calqued the maxim: "No remark without remarkableness." What makes climbing up a mountain more remarkable than climbing down it? Among mountain climbers reaching the peak of a mountain is the major goal: one cannot turn away only 100 meters from the top and claim for oneself the glory of conquering that peak. On the other hand, if one does reach the peak but does not make it back to base camp, he is still said to have climbed the peak. The achievement, as opposed to the activity, is more remarkable since it is by achieving the feat rather than performing the activity that one gets peaks named after oneself or sponsors a new line of sports wear. Perhaps verbs such as *climb* are general between the activity and achievement senses (see Vendler 1967) but the latter is more remarkable than the former. The implicature of upwards direction arises from the basic generality of *climb* plus the cultural or fraternal knowledge of why some one would undertake to scale a cliff, mediated by the conversational presumption that one should say something remarkable.[2] To utter something remarkable rather than something commonplace promises to further the goals of conversation by obviating the transmission of shared knowledge, which would serve no purpose in conversation. In maintaining this position, I reject Miller and Johnson-Laird's position (1976: 553) that:

> "Apparently there are some verbs whose incorporated directions can be over ruled by explicit expressions to the contrary and other verbs for which any additional specification of direction must be consistent with the incorporated direction."

They propose a lexicographic distinction for which there is no principled basis; it further weakens arguments based on ambiguity and variability, collapsing the distinction between semantics and pragmatics. Gruber's techniques for lexical decomposition as extended by Postal (1970) still make Gruber's original point: words encode tree-structures. The only claim that has to be altered is that instead of having identical prelexical structures, *climb, climb up*, and *ascend* all share identical sub-trees, but differ in containing other sorts of information.

Borrow and **Promise**

In this section, I will consider lexical items with accompanying implicatures that illustrate how a Conversational Implicature may suppress part of a word's conventional content. This is like Cohen's discussion (1971) of Grice's treatment of logical particles in natural language.

This possibility of suppressing part of a word's conventional meaning via conversational means raises serious questions of methodology. If it is, in principle, possible either to amplify or to diminish a word's conventional sense, how then can we ever tell when one facet of a word's conveyed import is implicated or is said? This seems like a classic case

of burning a candle at both ends. Could one not further reanalyze all the previous cases as encoding more conventional material parts of which are suppressed in context?

There is one way of escaping the dilemma although it may not prove very satisfactory : if we can calculate the implicature in only one direction (either from more content to less or vice versa) then we take that as the conventional meaning of the word. In cases where we can move in both directions Grice (1968 : Lecture III) suggests that we opt for less conventional meaning.

The lexical items dealt with here express a variety of interpersonal relations and transfers of entitlements among the participants in conversation. Consider the following sentences.

(19) Can I borrow { a cigarette / a hanky / your Olds } , please ?

(20) Would you { lend / loan } me { a cigarette / a hanky / your Chevy } , please?

I wish to claim that the senses conveyed in (19) and (20) are derivatives from lexical items that express complex contractual agreements These "parasitic" senses might be loosely paraphrased by (21) and (22), respectively.

(21) Could I { have / get } { a cigarette / a hanky / your Olds } , please?

(22) Would you *give* me { a cigarette / a Kleenex / your Olds } , please?

It is important that the verbs *borrow, loan,* and *lend* occur in indirect speech-acts such as *queclaratives* and *whimperatives* (see Sadock, 1975) Sentences such as *Lend me a cigarette* sound brusque without some mollifying phrase tagged on such as *will you?, o.k.? huh?* It sounds odd to my ears to report obtaining a Kleenex or Marlboro by the following sentence :

(23) ?? I borrowed { a Kleenex / a Marlboro } from Bill

(24) ?? Bill lent me { a hanky / an Old Gold } .

Borrow means something like the following : to receive entitlement for the use of an object X, originally in the possession of A, upon the condition that object be returned to its original owner as is (or in kind)." Buried somewhere in this heap of semantic atoms are the core HAVE or POSSESS. I must argue, then, that layer upon layer is stripped away until very little of the original remains.

I conjecture that these verbs are used for a particular reason : to acknowledge the petitioner's indebtedness to his potential donor. By requesting of the owner of the desired object the right to that object, the petitioner shows himself willing to take on unilaterally the burden of returning the favor in kind. It is a polite, self-abasing request.

Consider a sentence such as (25).

(25) Could I borrow a Kleenex, please?

The speaker indicates to his addressee that he wants to initiate a contract. But clearly the speaker is violating the Maxim of Quantity or Effort by overstating his case. The speaker needs a handkerchief, the addressee reasons, but he cannot be intending to return the same one due to our-shared knowlede about hygiene. He must, therefore, intend to return it in kind; giving me back another Kleenex or doing me a favour of comparable value. But the object is of such little value to begin with that it is hardly worth my trouble to hold him to his end of the bargain; and since he has gone to all this rigmarole to obtain it, he must need it. So he can have it. The implicature is easily cancellable.

(26) Could I borrow a Kleenex please? I just want to show Marge that her brand is only a 2-ply brand and that Kleenex with its corregated 5-ply structure is a better buy at twice the cost.

Such implicatures may be non-detachable, if verbs such as *barter, trade, transfer, consign,* etc. are substituted in the various frames. Note that the relative valuelessness of the desired item bears directly upon whether or not the implicature is carried out: it depends on the context. Thus *Could I borrow a car, please?* would not be construed as a request for a gift unless the potential donor were a multi-millionaire who was not attached to his stable of Vegas.

Note, too, the sort of verbs that may substitute in the frame.

(27) { Can / Could } I { grab / swipe / bum / mooch / appropriate / snitch / liberate / commandeer / annex } { a cigarette / a piece of your Egg McMuffin } please?

Here, manner is all important. The speaker may attempt to impress his addressee with his good bonhomous intentions by emphasizing the manner in which he wishes to obtain the object of his desires. *Borrow, loan,* and *lend* all emphasize a reciprocal agreement in obtaining an object.

(28) a Can I borrow a cigarette, please?
b' O k , but remember to give it back.
b'' Oh, you know what I meant.

(29) a Can I borrow a cigarette please?
b' Sure, you can have it.
b'' No, in fact you can have it.

(I am indebted to John Parry for (29) b''). It would be taken as very priggish behavior to follow the conversation in (28) rather than that in (29). These implicatures appear to be non-detachable and are prompted by the occurrence of these verbs within a grammatical context that specifies an indirect speech-act.

I choose Cohen's approach over Grice'e for the following reasons. First, if the conventional content of *borrow, lend, loan,* etc. were merely HAVE or POSSESS what features of these words could be exploited to arrive at a complex expression of transfer of entitlements with such ineluctable regularity? We would expect such implcatures to attach to words such as *have, obtain, get, etc. However, I know of no context in which this set of verbs* takes on the meaning of *borrow.*

(30) I got a guitar from Eduardo
(31) I borrowed a guitar from Lalo.

No context I know allows one to regularly calculate the meaning of (31) from that of (32). Thus, I suggest that in the appropriate contexts part of the meaning of *borrow, loan, lend,* is suppressed. While (31) entails loosely (30), the opposite entailment does not hold. The way in which these layers of meaning are stripped away strikes me as very similar to the way in which certain persuppositions are found to "vanish" (see Coleman 1975.)

I will make a few comments now on conversational implicature *vis-a-vis* explicit performatives. Consider the following sentences :

(32) { I promise / vow to } you that she arrived safely at the airport yesterday.

The speaker of sentence (32) does not so much establish a *promise* as he does a *guarantee.* Felicitous performance of promise requires that the act the speaker binds himself to executing occur in the future : the complement sentence must refer to a future time. I cannot felicitously utter a sentence such as :

(33) I promise to build the Brooklyn Bridge

All such promises are empty; one cannot take responsibility for something that has already been caused. However, (32) blatantly flouts this fallacy: its complement is a past tense one. This violates the Maxim of Quality (or perhaps Relation) : it is nonsensical to bind oneself to do something that is already done. The addressee of this sentence, however, knows this in virtue of his knowledge of what it takes to make a promise. Since (32) is empty, and since the speaker must recognize its vacuity, something else must be intended. The addressee begins to chip away at the semantic structure little by little until the speaker's contribution to conversation is once again Co-operative. The speaker is binding himself to be responsible for the content of the complement clause; he must believe that I - the addressee - doubt the content of the clause. He must, therefore, be vouching emphatically for the evidence which underpins the veracity of the content of the complement clause. Thus, the conventional content is weakened until the speaker's contribution becomes cooperative. The implicature seems to be non-detachable since verbs such as *vow, vouchsafe, give one's word, bet,* etc. may appear in (32) with much the same effect.

It is interesting to note that a similar alternation may be found among non-performative verbs that sub-categorize future oriented complements. Consider the following sentences.

(34) a I { expect / hope } that Bill will leave tomorrow.
b I { expect / hope } that she came in safely at O'Hare.

The case for this class of predicates is not as strong as with the performatives since the implicature is not non-detachable: *await,* and *look forward* do not enter this frame so well, although expressions like *pray that, have the faith that,* etc do. If one can attribute to all the members of this class a core of meaning "have X% confidence in" then it makes sense to understand why such verbs normally take future complements: one can be sure (or act that one believes one is sure) of past events and actions 100%, but not so of future events. Here I have not yet discovered a means by which I may ascertain whether verbs such as *expect,* etc. conventionally require future-oriented complements or whether they are general as regards the time commitments of their complement and the futurity normally required for remarkable, relevant conversation.

Cohen style implicatures are far rarer than Gricean implicatures, mainly because they involve violation of the Maxim of Quality: you must overstate your case. Fair and sportsmanly cooperation prohibits you from speaking about something for which you lack adequate evidence (or should induce a feeling a guilt if you do overextend yourself in such a way). Here as elsewhere, the calculability of the implicature suggests which direction we should go in.

Moral

The notion of possible lexical item has come to the fore in recent years; be exploring the interaction of implicature with the lexicon we may fill out the picture by investigating how the actual lexicon functions. Cases of the interaction of the actual lexicon with grammatical rules are not difficult to find.

Several vernacular negative existential quantifiers ($\sim\exists x$) limit the application of transformational rules. Consider these synonyms of *nothing*: *beans, zilch, crap.*

(35) a He doesn't know anything about syntax

b He knows nothing about syntax

(36) a He doesn't know {beans / zilch / crap} about syntax

b He knows {beans / zilch / crap} about syntax.

Dialects of American English exist in which (35) and (36) are synonymous. The quantifiers in (36)b retain their negative polarity inspite of the absence of an overt mark of negation. However, (35)b and (36)b differ in that the former, but not the latter, undergoes a variety of transformations: *There*-Insertion, Pseudo-Cleft, and Tag-Formation.

(37) a Max knows nothing about the climate of Tashkent.

b There is nothing Max knows about the climate of Tashkent.

c What Max knows about the climate of Tashkent is nothing.

d Max knows nothing about the climate of Tashkent, does he?

(38) a Idi knows {zilch / beans / crap} about humanitarian principles.

b ★There is {zilch / beans / crap} Idi Amin knows about Humanitarian principles.

c ★What Anita Bryant knows about gays is {beans / crap / zilch}

d ★Anita knows {zilch / beans / crap} about gay rights {?does she? / ?doesn't she?}

Most informants are unable to give a firm answer as to what the polarity of the tag should be in (38)d. I conjecture that the lack of an overt negative mark blocks the application of these rules.

English modals provide a striking case of a gap in a morphological paradigm that blocks the application of transformational rules even though other members of the paradigm would be homophonous: there is no suppletion. Modals lack an infinitival form even though it would be pronounced the same as the stem form (McCawley 1975).

(39) a I believe that Erwin is a dastardly spy.

b I believe Erwin to be a dastardly spy.

c Barny feels that Alice must be insane.

d ★Barny feels Alice too must be insane.

(40) a That Mary was out past 10:00 shocked her parents.

b For Mary to be out past 10:00 shocked her parents.

c That Wilson can leave work early is his prerogative.

d ★For Wilson too can leave work early is his prerogative

That this latter instance is due to a morphological gap and is an idiosyncracy of modals is borne out by the fact that in other languages such as German modals are endowed with an infinitival form.

We must be careful in the zeal to trim down our lexicon not to discard data that might be pertinent; we should err on the side of generosity. One must ask for each word this question posed by Grice (1968: Lecture III. 14): "On the assumption that a word has only one conventional meaning... how much are we to suppose to be included in that meaning?" The three instances outlined above describe a program for the investigation of the interaction of the lexicon with pragmatic rules governing the use of language in conversation. My basic theme revolves around the idea that what a word conveys in discourse can arise via pragmatic principles as well as through semantic rules.

All the implicatures discussed here dealt with how participants anchor themselves relative to the content of what is said (*go* and *come*); to one another (*borrow, promise*); and how they construe the relations that hold in the mental picture representing the content of what is said (*climb (up), ascend*). The orientation of the speech-event relative to what the narration is about is a major task for participants in conversation.

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NOTES AND REFERENCES

1. This sort of argument works when words are related to one another as *privative* or *scalar* oppositions (these terms are borrowed from N. Trubetsky's *Grundzuge der Phonologie* and extended to the lexicon in a fairly natural way). However this mode of argument runs afoul of *polar* oppositions: consider the following table.

ANIMAL	SPECIES	MALE	FEMALE
	lion	lion	lioness
	man	man	woman
	goose	gander	goose
	chicken	cock	hen
	horse	stallion	mare

Using the same sort of argument, one could say that *man* is general between two readings (i) species, *Homo sapiens*, and (ii) male of species, *Homo sapiens*. However, if such terms were general we would not know how to select the grammatical phenomena that accompany the generic versus non-generic distinction.

(i) The gnat is on your nose (non-generic).

The gnat is a pesky creature (generic).

(ii) The goose (you saw) laid no golden egg. (non-generic)

The goose is an avian.

We must maintain that the selection of the generic reading is due to meaning inherent in the nouns, instead of in, say, the definite article *the*. Similarly, *man* when understood as the male of the species *Homo sapiens* carries many connotations (eg. strength, machismo, secondary sexual characteristics, individual, etc.) which *man* when understood as species does not. Psychological research into the perception of others versus self as well as individual versus group is indicated.

If such cases turn out to be polar oppositions (based upon independent evidence), we see easily why the implicature proposed above would not work. That implicature turns crucially on the maxim of Quantity (e.g. the fact that *short* incorporates more information than does *tall*, namely 'LESS THAN'). Where polar oppositions exist, both poles are understood to have equal (but not identical) intrinsic content, therefore an implicature of the type proposed above would not be calculable.

2. Since *climb* carries a meaning of "along a vertical plane" (or "move with difficulty" *c.f.* Gruber's S *John climbed along the grass*) the addressee may fill in the direction of travel along that path to obtain a clearer picture of the content of what is being talked about. In this case, *up* represents the unmarked member of the pair of adverbs *up* and *down*. You disturb the mental picture you build less by adding *up* than if you were to add *down* which encodes more information

(i) How for *up* the slope is the chalet?

(ii) How for *down* the slope is the chalet?

S (i) can refer to a case in which the chalet is close to the bottom or close to the top of the slope, whereas (ii) can refer only to a case in which the chalet is relatively close to the bottom of the slope. If *down* figured importantly in the construction of the mental scene of events, the speaker would have been bound by the maxim of Quantity to supply that extra information. He did not do so, so the addressee implicates the upward direction.

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'*KARITTUNDU* AS AN ARTIST NOVEL : A CRITICAL ANALYSIS'

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Karittundu (1953)[1] is the story of a young, handsome and educated Bengali artist, Mokan, who falls in love with Nirmala, a beautiful but snobbish and fun-loving girl and marries her. After a short unhappy life because of temperamental incompatiblity between husband and wife, Mokan is promptly abandoned by Nirmala when he loses both legs in an accident. Disappearing from Calcutta, he turns up in Madras where he finds contentment in his life with a young widow, an illiterate coolie who worships him. Nirmala also lands up in the same city. Concealing her past, she enters into a platonic marriage with an American-trained professor of psychology, who is a native of Madras and there discovers by chance Mokan who has become a pavement artist to eke out his precarious livelihood. The rest of the plot is the story of Nirmala's 'conversion' through her realization of the artistic genius of Mokan and the reconciliation of her life with her second husband.

Mu. Va. employs the first person narrative technique in the novel. Tiruvenkatam, the narrator, is a Government clerk who stumbles upon his artist hero, when he is entertaining the idle and the curious on the pavement of one of the busiest thoroughfares in the city with his charcoal drawings of gods and great men and is at once fascinated by the amazing capacity of the physically mutilated man to work wonders with 'karittundu' or a piece of charcoal. The reporter of the story of Mokan and Nirmala is not even an amateur in his appreciation of art but a childlike creature overcome by what might be called the 'Renaescence of Wonder'.[2] Like the hero of a *bildungsroman*, he develops maturity of outlook on life and art in the course of the novel, a favourite of technique of Mu. Va.[3] Behind the persona of the narrator, one could hear the voice of the implied author, the perceptive political and social criticism of Mu. Va. the intellectual. A characteristic feature of his novels is the Socratic pattern of the dialogue between an interlocutor, who happens to be a close friend of the narrator - in *Karittundu* it is the arch socialist Kumaresan–and other educated men and women who debate political, social and moral issues which affect the interests of every Tamilian in the narrow context of his regional affiliation and the broad context of the nation.[4] These learned digressions were the very source of Mu. Va.'s popularity as fiction writer at a time when a new nation, after having won its political freedom from British rule was faced with serious problems of survival and selfhood.

The story of *Karittundu* begins in *medias* res, with Tiruvenkatam describing in an excited tone his first chance meeting with the crippled artist on the pavement. More than half of the novel is taken up with Mokan's retrospective but painful narration of his domestic infelicity with Nirmala in Calcutta and the tragic accident that drives him South and also Nirmala's epistolary confession of her betrayal of her lover, her flight to Bombay resulting in her meeting with Kamalakkannar and her coming down to Madras after her 'marriage' to h'm which on her specific request is not consummated. This is no plot in the Aristotelian sense of the word, with a beginning, a middle and an end. But the deft handling of the image of 'karittundu' whose use by Mokan after his abandonment of brush and palette marks a turning point in his life as both man and artist, contributes to the structural unity of the novel. Within this framework built round the central theme of art versus life, Mu. Va. permits his characters to debate familial as well as social life and also political and moral problems.

The theme of *Karittundu* is not the artist's search for freedom which is an obsession with Western writers, but the nature of the relationship between the artistic temperament and love. Are art and love (or sex) incompatible with each other? Mu. Va. treats love as superior to the demands of art, when he

allows Mokan to seek peace and happiness in the arms of the slum dweller Ponni by subordinating artistic temperament to female devotion. Mu. Va. takes the sting out of the vexed problem of art vs love by a categorical statement that art should remain subservient to life, since the autonomous condition of art can not only inhibit life but even wipe it out of existence. Thus he rules out the possibility of art and life being coequals and rejects the conventional view of the demands of art being superior to the demands of life.

A social reformer with a firm faith in certain ideals which would lift his sick society out of the rut of centuries-old superstitious beliefs and moral obscurantism, he repeatedly treats a single theme in his novels: family as the source of social stability and security. A hard-headed realist who puts no premium on moral maxims and political slogans for miraculously turning a conservative society into an egalitarian one he, concentrates his criticism on the traditional structure of the joint family system, particularly on parental tyranny. Life is hellish for a boy and a girl forced into matrimony against mutual consent by conformist parents and there is no release for them from a life of wretchedness and misery, as society frowns upon divorce. Every family which is thus affected by rot undermines the integrity of corporate life. Mu. Va. denounces parental interference in the choice of life partners for their children and even boldly advocates divorce against psychological and emotional maladjustment :

> (i) When man and wife discover incurable temperamental incompatability, they should have the right to divorce each other. As Shaw has said, no court of law should demand a reason for divorce. Marital life without the right for separation is a mockery of marriage. (5)

> (ii) In domestic life the mates seek comfort in each other's company. But if it breeds sorrow and suffering beyond remedy, it is as well that the marriage is dissolved. (6)

It is in the light of Mu. Va's belief in domestic happiness contributing to the well-being of society of which the family is the corner stone, we should view his handling of the theme of art in *Karittundu.*

Mu. Va's earliest reference to Mokan is as a young artist of reputation in Calcutta (p.242) who refuses to use his great talents for mercenery ends. Both his genius and his uncompromising stand on the autonomy of art distinguish him from his compatriots who look down upon him for his blunt refusal to make a living out of his art. Without conducting an ontological enquiry into the nature of art or exploring the psychology of art in its application to Mokan, Mu. Va. presents his hero as a martyr to art through the sacrifice of his legs. The Mokan who leaves the hospital after the amputation of his legs and the desertion of his wife has been transformed by his traumatic tragic experience from an artist who has dreamt of his own idealistic vision of life into man who has felt the full impact of the tragedy of human experience through the sacrifice of a part of his physical being. Chastened further by remorse over his lustful assault on an innocent girl, he accepts with infinite gratitude the shelter offered by Ponni when it dawns upon him that art divorced from life is a chimera; it should make itself a meaningful part of human existense by subordinating itself to the dictates of life.

When we speak of the artist and the man in Mokan, we cannot helf recalling the charge of critics against Mu. Va's characters that they are not made of flesh and blood but merely human types because they are built around ideas. [7] How far is this charge valid when levelled against the artist hero of *Karittundu?* we know nothing about his physical features except that is a cripple and our familiarity with him is severly restricted to our knowledge of his ideas on the relationship between art and life which are similar to the views of the author himself in novels like *Malarvili* which is an apt illustration of how an excess of devotion to art can warp emotions and prove destructive of domestic happiness. As something of Mu. Va. himself seems to have gone into the making of the narrator Tiruvenkatam who be friends Mokan with affection for the man and respect for the artist, we have a right to suspect that the protagonist of the novel is as much a product of the creator's head as his heart. And yet the portrait has more shade than substance.

There is a virtual debate on art in *Karittundu* in which the participants are the artist Mokan, the socialist Kumaresan and the intellectual Kamalakkannar. They do not directly clash but express their opinions to Tiruvenkatam who passionately

identifies himself with his artist hero. Kumaresan, whose prejudice against art has political roots, blindly states that any one who belongs to a profession is an artist in his own way, thus denying art an autonomous status and an integrity of its own. However, he does not hesitate to admit that an artist has delicate feelings. But to Kumaresan, the artist depending upon the kind of art to which he dedicates himself, perceives beauty - and not truth, though he does not care to define what he means by these terms. But the artist's perception of beauty is conditioned by a single sense and thus he tends to present a distorted version of reality His top-sided representation of of truth has its sweet revenge on him by depriving him of his natural capacity to enjoy life fully and as a result he not only ruins himself but also his dependants. It may be noted that Kumaresan's view of art and artists is not only coloured by his political affiliation but also by the opinion he has formed of Mokan from Tiruvenkatam's version of his life

Kamalakannar, whose thinking has been very much conditioned by his exposure to the intellectual climate of American Universities, bluntly states that art, which he equates with manual painting, is hopelessly dated (to use an American expression) in a world of cinematic and technicolour perfection, and machines can produce paintings like pins. Though he has the scholar's contempt for the visual arts, he occasionally relents and admits that art can be useful in channelizing and sublimating the more dangerous human passions and that the aesthetic sense refines feelings, the very reason for which arts were encouraged in ancient India.

Mokan, whose dedication to art is deeply tinged with his vision of life, gives a psychosomatic explanation of the artistic process and bewails the utilitarian motive behind the world's encouragement of artists. He considers art as a primitive deity demanding blood sacrifice from its devotees and few can survive her worship. When the artist is in the throes of creation, every nerve in his body is unbearably tense until he bodies forth his abstract conception. The creative act, which involves simultaneously physical struggles and mental struggles, leaves the artist in a state of utter exhaustion of the boby and that accounts for the delicate health of painters. Mokan's view of the artistic process which borders on the mystical saps both mental and physical energy. But what explanation can one give for the physical health of many painters who are fit as a fiddle? Mokan speaks out of his bitter experience of life when he asserts that art like love is always engaged in a fruitless search for beauty and excellence, whatever he may mean by them, only to discover that affection alone is stable in life. It is Mokan's view of art in its relation to life that triumphs at the end.

Mokan and his first wife Nirmala are drawn towards each other by their common interest in painting. But brought up in an ostentatious urban environment, she is attracted by the glitter of the social life of the upper class to which she belongs and despises her husband for his single-minded devotion to art. Her crime is solipsism and the casualties of their life maladjustment are love, charity and gratitude, as Mokan observes later.

The loss of his legs is symbolic of his deliberate renunciation of his old identify as an artist who lived only for his art Then a remarkable change comes over him in Madras, when Kantamma's husband, who is a coolie, accepts him as a member of his household, at a time when he has given up brush and palette and taken to pencil-drawing, an indication of his indecision to take the next step in order to ensure his future. The beauty of Kantamma in her defenceless sleep arouses the animal in him, but she saves herself from sexual outrage by appealing to the gentleman in him. In bitter memory of that shameful occasion and as an expiation for his guilt, he resorts to charcoal-drawing. The charcoal or 'karittundu' is not only symbolic of his purificatory penance with all the dross of animal passion burnt out of existence, but also of his attainment of maturity as an artist brought about by self-realization. The charcoal is a profound metaphorical representation of finished art at the heart of which lies Mohan's deep understanding of life without which art can only have an incomplete existence.

Mokan himself does not seem to realize the full significance of his 'conversion' as an artist to the medium of charcoal until the widowed mother Ponni comes into his life and it is Kannamma who recommends her to his attention. She offers herself to him with uninhibited candour and pure love and Mokan calls her the lamp of his life. Whereas Nirmala in her life with Mokan treated the family as a stepping stone to

enter and exploit the world of art, Ponni guiding Mokan into the harsh realities of life, teaches him to use art as a ladder to reach at an understanding of life. His metaphor of life is deeply signicant: life is a temple, with love as its foundation, sacrifice as its lofty lower and joy and sorrow, the sculptural pieces adorning the face of the temple (p.207). In terms of aesthetics, the temple is the finest efflorescence of the Tamilian's love of art and here it becomes a unifying symbol of life that predominates and art that subordinates itself to life. Mokan earns his livelihood by a limited display of his talent with charcoal to support Ponni and their children; in his physical condition which will engender pity and compassion he would not seek public charity by displaying his art daily on the pavement lest he might be debasing his art. Thus he strikes a compromise between life and art.

NOTES

1. Derivative in origin, this paper was originally part of a longer paper, 'Two Artist Novels in English and Tamil' accepted for reading at the International Conference of Comparative Literature on East-West Literary Relations, Taipei (1975)

2. Mu. Varadarajan, *Karittundu* (1953; rpt. Madras: Pari Nilayam, 1969), p.16. All page references given in parenthesis are to this edition of the novel

3. See my paper, "Dr. M. Varadarajan and Somerset Maugham as Novelists: A Sample Study" Dr. Mu.Va. (Collection of research paper on Dr. Mu. Va.), ed. S. V. Subramanian and A V. Manavalan (Madras: International Institute of Tamil Studies, 1975) pp.19-36

4. In using art form as a forum for a free discussion of lively issues, Mu. Va. may have been influenced by one of his favourite writers George Bernard Shaw on whom he wrote a very popular book in Tamil (1948).

5. *Alli* (Madras: 1952), p.287. English translations of passages from Mu. Va.'s novels are mine.

6. *Nencil Oru Mul* (Madras: 1956), p.280 See also Era Mohan, *Mu. Vavin Novalkal* (Madurai: Sarvodaya Ilakkia Pannai, 1972), pp 61-74.

7. K. Kailasapati, *Tamil Novel Ilakkiyam* (Madras: Pari Nilayam, 1968). p.230 Era. Mokan's spirited defence of Mu. Va. is unconvincing. See *Mu. Vavin Novelkal* p.48. See also his *Yan:Kanta Mu. Va* (Madurai: Sarvodaya Ilakkiya Pannai, 1975), pp.43-45.

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JUSTICE IN THE 18th CENTURY MADRAS*

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ABSTRACT

The establishment of the Mayor's Court at Madras soon after that of Admiralty Court-Reasons for such an establishment the Hindu resistance to the Collection of house-tax for defraying-the cost of building a wall round Black Town, the nucleus of modern Madras City - suppression of the strike-Composition of the Corporation the powers of the Mayor's Court - Punishments meted out in those days - the prevalence of Jury system in the trial of Civil cases - the introduction of English Law by the Charters of 1688 and 1726 foreshadowing the parliamentary interference that first took shape in the regulating Act of 1773 - the effects produced by the establishment of the Mayor's Court - the relationship between the natives and the Mayor's Court - recommendation for the appointments of professional judges for the civil and criminal courts - contribution of the Mayor's Court to the development in India of a high standard of Justice-Reason for the exclusion of Indians from any share in the work of the Bench - only in the 19th Century Indians came to be associated as judicial Officers in the administration of justice.

The Mayor's Court was established in Madras soon after that of Admiralty Court for the following reasons. One was that it was due to disturbances that occurred in Madras in January 1686, when the Hindus in Back Town, resorted to strike methods. The object of the Hindus in resorting to strike methods was to resist the collection of a house-tax which had been imposed upon them by the company to defray the cost of building a wall round Black Town. But the firm and quick action by Governor Pitt and his colleagues suppressed their strike and the tax was then collected without difficulty. There is good ground for saying that the company thought that the new corporation would make taxation of that kind more acceptable to the native population for this was expressly stated in its first despatch about the proposal.

The idea of the Company was that by setting up a Corporation of "The Natives mixed with some English Freemen" and giving it some small powers and privileges, the caste leaders as Aldermen and Burgesses would be ready to tax themselves and the inhabitants generally for various municipal purposes. Accordingly, the Charter, while providing that the Mayor and the three senior Aldermen should always be covenanted British Servants of the company, allowed the remaining nine Aldermen to belong to any nationality; and a French man, two portuguese, three Hindus and three Jews or Armenian merchants were among the first Aldermen nominated by the Company. It was also laid down that thirty of the sixty Burgesses were also to include the heads of all the casts in order to induce the Hindu inhabitants to contribute cheerfully to the public works that were contemplated. The proposal had much to commend it, but like many western innovations when transplanted to Asiatic soil, it did not quite work in the way intended. Nor did the Corporation raise any taxation or establish any institution of the kind contemplated. On the contrary the Governor and Council had to assign town revenues to it to prevent it from falling into bankruptcy. But this was not the one and only reason for the scheme. The Charter itself recites as its justification that the company had found by Experience and practice of other European Nations in India that the making and establishing of Corporations in cities and Towns that are grown exceedingly populous tends more to the well-governing of such populous places, and to the increase of trade, than the constant use of Law martial in trivial concerns and expresses a desire to provide for the speedier Determination of small controversies of little Moment, frequently happening among the unarmed inhabitants of Madras." The reference to other European Nations was one mainly to the Dutch. The raising of Madras to a 'Regency' was another imitation of the Dutch arrangement.

* **Part** of M. Litt, thesis

The company was no doubt encouraged in the idea of having a Mayor and Corporation by the presence of Sir John Biggs at Madras. They first of all put it forward tentatively and sent to the Madras Council a copy of the Charter granted to the Borough of Portsmouth 'where' they wrote 'Sir John Biggs was Recorder and therefore understands well not only that constitution but the practical way of proceeding in it' Within three months, however of their letter, the company finding that the idea was approved by the King, determined on its fulfilment and in January 1686 sent out an engrossed charter with an intimation that if any amendments were found necessary, this would have to be done by a supplementary Charter. The Mayor's Court was thus merely a Company's Court until it was superseded in 1727 by one established under a Royal Charter.

When the Admiralty court ceased to operate owing to the death of Sir John Biggs, there was no court authorised to hear appeals from the Mayor's Court. In this emergency Yale and the majority of the Council set up a temporary Court of Judicature consisting of himself as Judge-Advocate and two Justices, who were members of Council. With them were associated two merchants, one an Armenian and the other a Hindu, to assist them in regard to native language, laws and customs. This court subsisted till 1692 when the Company sent out a new Judge-Advocate, John Dolben. The court of Admiralty then continued till June 1704, when on the incumbent Judge-Advocate's return to England, it was decided that his office should remain vacant. Admiralty jurisdiction thereafter appears to have been exercised by the several Governors and Councils under royal commissions issued in conformity with the Piracy Act of 1698 and similar enactments. The Governor and Council had also by 1704 constituted itself the Court of Appeal from both the Admiralty and the Mayor's Courts.[1] This was probably based on the Company's instructions to Pitt, when he was appointed Governor of Madras in 1698 that the President and Council should hear appeals in cases where the matter of the complaint was not less than 100 pagodas. Previously the Mayor's court had contended that in the absence of the Admiralty courts, their decisions were final.[2]

In Madras English Magistrates had exercised their jurisdiction from about 1654, in place of the native *Adigar* or Town Governor who had formerly done so.[3] As they sat at the choultry (Town house) they were called the choultry justices. Streynsham Master enhanced their number from two to three and confined their summary jurisdiction to 'cause of small misdemeanours, matters of the place, and actions of debt of the value of 50 pagodas and under,' unless the parties agreed to their exercising powers. He also allowed an appeal to the Governor and Council, there to have a trial by Jury.[4] Though the civil jurisdiction of the Justices was replaced by the court of Requests established in 1753 they continued to exercise criminal powers till a late period in the 18th century and the court continued to exist till 1800.[5] The justices were members of the council except for a short period (September 1688 to November 1889), when Aldermen of the Mayor's Court took their places.[6] The senior of them was styled the Chief Justice. The ordinary punishments they inflicted were whipping, fines, imprisonment and the pillory.

Except for the short periods of two years that Sir John Biggs (1687-9) and John Dolben (1692-4) presided over the court of Admiralty at Madras there was no trained lawyer employed by the Company and the judicial administration was carried on by Company's servants in a rough and ready, but generally just and sensible manner. Punishments in criminal cases naturally followed the prevailing severity of those days, but the death-penalty was usually not inflicted except in cases of murder. Thus sentences of death for theft or robbery passed by the Mayor's court were commuted.[7]

From 1688 to 1727 the Jury system prevailed in the Mayor's Court. Thus cases were so tried in 1689 and 1718.[8] The consultation entry of 16th June, 1718, states that the trial was in the Mayor's court 'not' 'by' that court and this points to the trial having been by jury. In the Mayor's Court, it is clear, the civil cases were tried with a Jury. Thus the petition of appeal from the Mayor's Court appended to the consultation of 10th September 1719 clearly shows that the decision was by the Bench. The Charter of 1726 provided for trial by

Jury only in criminal cases and in the dispatch about it to Madras the company said that it empowered the Mayor's Court to 'Try all civil causes after the manner they used to do formerly'.

The Charters of 1688 and 1726 which established the Mayor's Court in Madras meant the authoritative introduction of English law in the presidency towns and foreshadowed the Parliamentary interference that first took shape in the Regulating Act of 1773.[9] The establishment of the Mayor's court did not imply a condemation of the existing courts which needed improvement. The assertion that 'Justice gained little by the establishment of the Mayor's Courts' (Kaye) calls for comment so far as it implies that the justice the Mayor's court administered was bad and inefficient. The Mayor's Court on the other hand resulted in distinct and remarkable progress in the administration of justice according to the principles and practice of the English Courts of Law. It formed an useful link in the chain that led to the establishment of the improved law courts in the 19th Century.

Another important link was the institution of trial by Jury for all criminal cases in the sessions court of Oyer and Terminer set up by the Charter. The novelty in India of having a grand jury of 24 for preliminary finding of 'true bill' was also introduced. Of course, this was a natural reversion to previous practice but the adoption of trial by Jury was a significant change from the attitude of Sir Josiah Child in 1687.

The Charter also showed restraint in the authority it conferred on the President and Council over the Mayor's Court. While they could remove an Alderman for misconduct in his office, they could only do so after a proper hearing of his defence and not for extraneous reasons.[10] Although they became the courtof Appeal from decisions of the Mayor's court this was subject to a right of appel to the Kings-in-Council in all cases where the value of the property in dispute exceeded 1,000 pagodas (about Rs. 3,000).

The Mayor and Aldermen were usually members of the Grand Jury at a Quarter session and sometimes annoyed and irritated the Council by making presentments that did not show 'due respect' to their authority. A dipute over the form of oath arose in Madras and when the Court in 1736 imprisoned two Merchants for refusing to take the oath called 'pagoda oath',[11] a great crowd of Hindu residents invaded the Fort and complained to the Governor, at whose interference the men were released on parole. This naturally increased a tension that had developed into disputes between the Court and the Council during the previous three years.[12] The latter complained about the court's conduct and its - ill consequences. With the result the company after obtaining the opinion of their standing counsel replied.[13]

"We must say that it too plainly appears to us from the past conduct of the Mayor's court that they are too apt to assume a greater power than does legally belong to or become them and that they have been wanting in a due deference and respect to you their superiors in that Awe and Reverence for the Company, and concern for the welfare of the settlement which we expect from all who reside under our protection. And we hereby acquaint them once for all that, in case any such like cause of complaint in future is given us from that quarter, now their duty is so plainly laid before them, we shall not suffer those who disregard the wholesome advice which is given them to Trade within our limits. At the same time we expect that you on your part will do nothing to obstruct the regular course of justice or discountenance those who have a seat on the Bench while they have prudently and uprightly in the said station and keep within the due bounds prescribed by the Charter.' It repeated this 'whole some advice' next year in consequence of reports that the Court still acted in an unbecoming manner towards the Government.[14]

Another stimulus towards the proper administration of Justice came from the Company's supervision of the courts in general and the Mayour's Court in particular. Copies of the Registers of their proceedings were submitted annually and were subject to scrutiny by counsel employed by the Company. Its dispatches of 1729, 1730 and 1731 include many pages of comments on the proceedings that are obviously based upon his remarks. In the main the remarks impressed on the courts the fundamental principles of English Law that ensured a fair trial and gave them useful instructions on many points. At the same time the Company was cautious and careful to make it crystal clea that it only tendered its opinion and advice which

it doubted not, would be followed as far as it was found to be just and reasonable. With the Charter the company had sent each Presidency a Book of instructions and multifarious forms as to the method of proceedings in civil suits, sessions trials and probate and administration work. It will thus be seen that the company made considerable efforts to keep the courts in the straight and narrow path of English Law.

The Company's insistence on English Law had of course its effects. It was in many respects unsuitable for the prompt and satisfactory disposal of civil and criminal cases in which the Native inhabitants of the Settlements were concerned and the difference between the conditions of England and those of India and between the atmosphere of Westminster Hall and that of the courts in India, was apt to be over looked. But inspite of this, the Company's supervision prevented illegalities such as the attempt of the Madras Council to set up a Sheriff's court for the recovery of the petty debts and to make a standing order for the court's guidance in a matter of procedure. It deprecated the old and time-honoured punishments of thiry-nine lashes and pillory and approved of juries in India as in England.

Most of the litigation in the Mayor's court was dealt with in a prompt and satisfactory manner. Any reader of the Registers (they are worth looking into also for other reasons. Prof. Dodwell's *Nabobs of Madras* shows how details of historical and social value can be found in them) with legal knowledge or judicial experience will realise that, the Mayor's court judged the cause before them with apparent fairness and in a sensible manner that was none the worse for its avoidance of legal technicalities.

On the other hand, the fact that native inhabitants could object to the jurisdiction of the Mayor's Court led to difficulties. The Company's admonition that they should settle disputes among themselves was bound to be largely futile in the absence of other courts where such disputes could be litigated. In Madras the only other court available for civil litigation was the Court of Requests, established by the Charter of 1753, in which only suits of a small pecuniary value could be tried. In 1770, the Council decided to establish a court for determining disputes dependent on the customs of the natives, but this resolution was not carried out till 1795 when (acting under powers conferred by the charter Act of 1793) the Governor and Council established a special 'cutcherry court' for this purpose.[15] But its existence was ephemeral owing to the inauguration of the Recorder's court in 1798.

Before this, however, even the company's ideas were changing and in 1786 they indicated their desire 'to accommodate their views interests to the subsisting manners and usages of the people rather than to any abstract theories drawn from other countries or applicable to a different state of things'. The time had arrived for a change. This is well-put by the Madras Council in the following passage from a letter to the company in 1791[16], "upon the whole we would submit for consideration and advice the propriety... of having professional judges for the civil and criminal courts".[17]

They accordingly recommended the propriety of having professional judges for the civil and criminal courts. This proposal had already been adopted in Bengal where the Supreme Court put an end to the Mayor's Court in 1774. In Bombay and Madras it lasted till 1798, when it was substituted by the Recorder's Court. The system of confining the administration of justice to the convenanted servants or freemen of the company thus ended, and the professional lawyer took his place.

The Courts of those days in general and the Mayor's court in particular, in spite of their defects, made an effective contribution to the development in India of the high standard of justice that is one of the pillars of the British Empire. But this contribution however lacked an important element of present day conditions . The early Courts had practically excluded Indians from any share in the work of the Bench. The only exceptions were the appointments of Indian Merchants to the Bombay Court of Judicature in 1718-1728 and the similar arrangement in Madras between 1687 and 1692. Under the Charters of 1726 and 1753 the only capacity in which Indians could participate in the administration of justice was as jurors in the Sessions Court but privilege was restricted to those professing the Christian religion. This was not specifically stated in the Charters, but was indicated by the provision that the jurors

should take an oath similar to that taken in England. It was not till 1826 that Wym's Jury Act allowed Indians not professing the Christian religion to serve on petty juries. There was of course a reason for this exclusion. In English settlements that were merely mercantile and liable to attack from hostile neighbours, such a policy was almost inevitable. It was only in the 19th century that Indians came to be associated as judicial officers in the administration of justice.

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MR. PYBUS' MISSION TO THE KING OF KANDY

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ABSTRACT

The paper **Mr .Pybus Mission to the king of Kandy** *aims to focus attention on the exit of the Portuguese and Dutch from Ceylon and the entry of British East India Company. The orders of the East India Company to Pybus and his protracted journey to Kandy and the unaccustomed salutation to the king and his meeting with him is described. Special attention is made to bring out the treaty clauses and its impact in the later history of Ceylon which however resulted in the capture of Trincomalee by the British. In conclusion the Madras administration on Ceylon and the creation of the crown colony in the latter part of the eighteenth century is discussed in this paper.*

Ceylon, an extensive and beautiful island forms an appendage to South India. Kandy, the old Capital of Ceylon is the Cheif town of the central province being noted for its natural wealth and coffee production and is connected by rail, with Colombo. [1] an English gentleman Mr. Pybus, of Madras Government went to Kandy in A.D. 1762 as an emissary to promote commercial relation between Madras Government and Ceylon.

In A.D. 1505 the Portuguese were the first European settlers to reach Ceylon and assume many trading rights. Subsequently in 1602 the Dutch arrived in Batticaloa and the fall of Jaffna in A. D. 1638, marked end of Portuguese regime in Ceylon. Though the relationship between the King of Kandy and Dutch was cordial at the beginning, they had in many ways harrassed the King of Kandy and in particular, by their power to deprive him of his authority and reduced him at last to comply with all their demands.[2] Soon the king of Ceylon solicited the assistance of the English against the Dutch, and accordingly the Madras Government despatched Mr. Pybus entrusting him with the mission of visiting the King of Kandy.

Having received the Company's instructions on 6th April 1762, Mr. Pybus started on his mission. He was accompanied by a Linguist, Vakeel and the servants of Admiral Cornish. He reached Triconamalee Harbour safely at 3'OClock on the morning of May 5th 1762. He was carried in a pallankeen or dooley to the King along the mud-paths and he crossed Moodoor, Clevetty, Mavell Ganga, Soongavilloo, Pangaranny, Tritoly, Vishegalloo, Nantchetolum, Gonagy, Carvetty, Gunnoor and reached Kandy travelling a total distance of 207 miles.[4] Though pressed by so many difficulties he could at last meet the King on 24th May 1762.[5] After welcoming Mr. Pybus, the generals of the King of Kandy compelled him to remove his shoes on entering the open veranda of the palace. Also they asked him to hold the letter in a silver salver, covered with two or three pieces of muslin and to carry holding it a little above his head. Mr. Pybus refused, but he was compelled to do so, for it was the custom of the people of Kandy to do so while visiting their King. Mr. Pybus complied with their request and at that they played native music and fired eleven guns as a mark of respect for the emissary.[6] On approaching the king they again compelled him to kneel and Mr. Pybus refused to do so, and said that he did not come on the footing as the Dutch Ambassadors do; that he came at the Kings' particular request. But when he came near the Kings Court, the guards standing outside pulled him down by his coat and forced him to kneel down upon the bare ground holding the silver dish above his head. Mr. Pybus after doing so, presented the letter to His Majesty.[7]

After reading the letter His Majesty asked Mr. Pybus whether the Governor General in Council of Madras will be his true friend or not; to which Mr. Pybus replied in the affirmative; and added that the King would find the English faith.

ful to any agreement they might enter into with him; that the Governor and Council in Madras, in particular were very heartily inclined to be his steady and sincere friends.[8] After listening to all the promises, the King of Kandy consented to an alliance with the English on the following terms:

1. That the English East India Company shall have permission to establish a settlement or settlements in the Bay of Cottiarum, in the river of Muttu Cullapay or Batacal, or in the River Chilann, in the Districts of Annawolandane or at any other place on the sea coast of the island of Ceylon, as they shall hereafter find most convenient for carrying on their trade, which now is, or shall hereafter be in the possession of the King, giving notice to the King of their intentions of establishing such settlement, before they erectany buildings there.

2. That the English East India Company shall have no liberty to provide, and His Majesty shall issue but orders to his subjects to furnish them with Cinnamon on the same conditions quantity as they shall have occassion for, to be at such settlements as shall be hereafter agreed upon : and his Majesty is requested to issue orders for collecting, with as much despatch as possible, a quantity of Cinnamon, at Matuculapay, in readiness for a ship which may be sent for it in September or October.

3. That no Pepper or Beetlenut commonly called CotahPakoo, shall be sold by any of His Majesty's Subjects to any other but the English East India Company, to whom they shall be obliged to deliver those Articles on the same terms they were delivered by them to the Dutch.

4. That His Majesty's subjeets shall have free liberty to bring their goods, from any part of His Majesty's Dominious to the English Settlements, without receiving any molestation or interruption from any person or persons whatsoever.

5. That His Majesty's subjects shall be prohibited from carrying on any trade with, or carrying any of their commodities to, any other settlements or places, but those of the English East India Company.

6. That His Majesty, on application being made to him, shall issue his orders to his subjects to furnish, on being paid for them at reasonale rates, such timber, stone, or other materials etc.

7. That in case, the English should find it necessary at any place or places, where they shall have His Majesty's permission to settle, to pull down, or remove any house or buildings if they see proper.

8. That any European belonging to any English settlement, ship or vessel, any person that shall have been guilty of any crime or offence, any servant or slave belonging to the English, or inhabitants living under their protection and government, that shall have deserted or run away from any of their settlements into the King's Territories: shall, on application made to His Majesty by the Governor of the Settlements from whence they shall have deserted, or run away, be delivered up as soon as possible after such application has been made; and *vice versa.*

9. That the English at all places where they may have settlements shall have the previlege of trying and finishing by Laws of their own Country etc.

10. That at any time when it shall be found necessary for the English to assist His Majesty with troops, His Majesty shall oblige himself to furnish the necessary service.

11. That such Officers as shall be employed with the Troops in the field upon His Majesty's Service, shall have the liberty of travelling either in *Pallankeens* or on horseback to or in any part of his territories, where they shall be employed upon such service.

12. That the same allowance of Batta shall be paid by His Majesty to the Officers of the Troops while in the field as are allowed them on the coast of Coramandel.

13. That all sorts of Military or other Stores which shall be extended, broken or lost on the king's services, shall be paid for by His Majesty.

14. That in consideration of the great expense which will attend erecting fortications, warehouses and other buildings at such places as the English may settle at, and for maintaining a Military force for taking the field whenever the King shall have occasion for their Service, His Majesty shall make over to the English East India Company for their

sole use and benefit and as their property for eevr, certain Countries or Districts, from whence they may be enabled to reimburse themselves for such heavy charges.[9] After fulfilling his mission Mr. Pybus started his return journey on July 3rd 1762.

The Mission of Mr. Pybus, though left very little impact immediately upon history proved more useful in the later years and made the British to Capture Triconamalee in A. D. 1782. In 1796 the Dutch forts were ceded to a British expedition from India, and the maritime Provinces became a British possession by the right of conquest. The desire of the king of Kandy to throw off the yoke of the Dutch in the island was achieved. In the beginning the Provinces of Ceylon were administered from Madras and when that arrangement was a failure, the British Possessions in Ceylon were separated from India and led to the formation of a crown colony in A. D. 1802.

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DISTRICT AS A UNIT OF REGIONAL DEVELOPMENT IN INDIAN PLANNING

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SYNOPSIS

Regional economics a new area of specialization based on theoretical developments about general inter-dependence systems is discussed. There are usually three approaches for defining a region : 1) homogeneity with respect to physical, economic, social or other characteristics; 2) polarization usually around a central urban place and 3) a single administrative set-up for implementation of programmes or policies.

In many developing countries the problem of balanced development of different regions has assumed much significance. In India the district is a region which is a local administrative division and cannot be considered as having common economic characteristics. So the district planning presents problems which are comparable with those of planning for the development of a larger stage with a heterogeneous composition.

Indian planning is a highly centralized - integrated plan of development undertaken by the Planning Commission at the Centre. Planning at the lower levels continues to be in the main a matter of putting together standard schemes for each department or for each activity in the expectation that such schemes are likely to attract the largest amount of assistance from the centre. The two primary requirements for district planning are knowledge regarding local conditions and participation in planning effort by local people. The policy of the government in regard to district planning indicated in the Five Year Plan reports are discussed.

Regional economics[1] is a new area of specialization in economics. The theoretical developments in general economics particularly those related with general inter-dependence systems provided the conceptual basis. A fortuitous blending of many economists' desire to apply certain recently honed conceptual tools and policy makers' desires to seek more adequate and analytical answers to complex problems related to regional and urban growth led to a development of the study.

Regional economics is simply *all* of economics scaled to whatever level is required to adequately measure or forecast economic activity for a specific geographic area. Regional economics is defined in terms of particular study aud policy objectives. There is an emphasis of its pragmatic origins. The distinguishing characteristic has almost seemed to be its interdisciplinary aspect.

An analyst is perplexed with many problems when he looks at a region. One problem may be to identify specific industries which are well-suited to that region. Another related problem may be to improve the welfare of the people of the region, that is, to raise per capita incomes and perhaps achieve a more equitable distribution of income[2].

Traditionally three different approaches have been used in defining regions.

1. homogeneity with respect to some one or combination of physical, economic, social or other characteristics,

2. nodality or polarization usually around some central urban place and

3. programming - on policy - oriented concerned mainly with administrative coherance or identity between the area of study and available administrative institutions for effectuating policy decisions.

The availability and limitations of data can and do dictate departures from "ideal type" determination of regions.

There is emphasis on the homogeneity of the region. The programme or policy region is essentially homogeneous in being entirely under the juris-

diction of some one or a few specific government or administrative agencies. A nodal region is homogeneous because it combines areas dependent in some trade or functional sense on a specific centre. The homogeneous regions are homogeneous with respect to physical characteristics like geography or natural resource endowment, while others are considered to be similar in their economic or social characteristics. Finally homogeneity with respect to statistical compilations may often be the real determinant of regional boundaries for practical purposes.

The most helpful region in many instances is what might be called the economic development region where the emphasis is on the development of policies, programmes and actions to move the region from where it is economically towards pre-determined economic objectives.[3]

In many countries experiencing rapid economic development, the problem of balanced development of different regions assumes great significance. It becomes important to know whether in important spheres of economic activity there is adequate development in the different regions. Urban problems and analyses have assumed an increasingly dominant role in empirical research in the United States. The great strength or appeal of regional analysis is its essentially pragmatic character and in particular its willingness to integrate theory and data and to undertake empirically difficult analyses.

Two types of approach are adopted for regional studies. In one the emphasis is on historical and behavioural charactertistics; in the other the orientation is more toward quantification and forecasting. These distinctions are somewhat arbitrary. Those with an historical behavioural inclination often try to make quantitative forecasts and those with an analytical - quantitative approach normally will try to have an understanding of underlying behavioural patterns.

The need for the study of a region arises from the fact that a greater knowledge of the region will be helpful for the purpose of policy formulation. In India the district is a region because it comes under a single administrative set-up.

In terms of the division of the main functions of the government there are in India three tiers viz. the union, the state and the district. The district development planning has become an integral part of national development planning[4]. The centre is concerned with the formulation of the plan for economic development. The states have to engage themselves in transmitting the forces of impelling economic development to all areas and units. The same fields of activity are applicable to the districts.[5] The spatial i. e. district patterns will change with shifts in the structure of demand and of production, in the level of technology and in the social and political organization of the nation. The regional or district planning may take the planning and strategy formulated at the national level for granted and specially addresses itself to the specific spatial feature emerging in the formulation and operation of a national plan in a particular region. The district which is a local administrative division cannot be considered as a region which is defined as a contiguous territory sharing common economic characteristics. The economic homogeneity would be a matter in part of accident and in part of the fact that the district forms part of a larger region which may be economically homogeneous. So the district development planning presents problems which are comparable with these of planning for the development of a larger state with a heterogeneous composition. The total national plan of development of all activities and classes and all region is a multiobjective plan with universal coverage. It follows that the development of any area or district, however small has to be equally comprehensive in the definition of its objectives and the scope of its action. The development attempted, must affect all areas within the district and must touch all activities and all classes. As local planning has to be undertaken for all areas it is obvious that the effort should be associated with the administrative and the self government areas into which the country is already divided. The local planning is therefore to be undertaken at the district level. The local planning becomes identical with the district planning.

Indian planning is highly centralized - integrated plan of development undertaken by the Planning Commission at the centre. Planning at the state level is not only highly officialised but is essentially a secretariat affair.

The almost entire absence of proper planning at the state and district level has imposed a grave handicap on development of Indian rural economy and is reflected in the relatively slow and patchy

progress in agriculture, rural industry and related fields[6]. Planning from bottom has to be associated chiefly with district development planning effort. For, the lowest stratum of government authorities is the district. The two primary requirements for district planning are (1) knowledge regarding local conditions and (2) association of local people with formulation and implementation of the plan. The technical information is inadequate and relevant economic information is almost totally absent. The extension of investigational and research activity in all the fields at the local level is a necessary concomitant of the continuance and growth of the district planning effort[7].

The policy of the government in regard to district planning is indicated in the Five Year Plan Reports. The First Five Year Plan Report has stated that the principal unit of administration is the district and the district officer is the government's principal representative in touch with the people. The district administration derives increasingly its significance in developing the resources and raising the standard of living of the people of the district[8]. According to it the primary emphasis in district administration has to be on the implementation of development programmes in close co-operation and with the active support of the people. The district plans are essential but they may gain in importance if they are also part of well-considered regional plans[9].

The Second Five Year Plan Report has stated that with the acceptance of a welfare state as the objective the emphasis in district administration has come to be placed overwhelmingly on development activities. Large scale programmes for agricultural development expanding and improving the co-operative movement and promoting village and small industries and the development of urban areas are according to it the new responsibilities of the head of the district administration viz. the district collector[10]. The plans for districts and villages merge into the state plan which in turn has to take cognizance of plans prepared from the point of view of the country as a whole. In the implementation of the state plan, its break up into district plans is an essential step. In particular in different sectors in the State plan, programmes or schemes in which local participation and community action have a special contribution to make are to be separated out and shown as constituents in the plans of districts. The significance of the district plan lies in educating public opinion, in bringing together various programmes in the district within a common frame and in developing community participation co-operative self-help and local initiative and leadership[11]. At the district level the primary object as per the Second Five Year Plan is to co-ordinate the work of various agencies concerned with development and to associate with them representatives non-officials and others who may be in a special position to assist.

The goal of balanced regional development has been advocated in the Third Five Year Plan Report. "Balanced development of different parts of the country, extension of the benefits of economic progress to the less developed regions and wide spread diffusion of industry are among the major aims of planned development"[12]. It is pointed out in the report that sometimes the sense of lagging behind in development is due not so much to a slower rate of overall growth in the region as to inadequate development in specific fields such as agriculture, irrigation, power or industry or employment. It becomes necessary to make a study of the nature of the problem and the impediments to rapid development in each region in particular fields so that appropriate measures can be devised for accelerated development. Among the policies that are suggested for regional growth in the Second Five Year Plan, one is to give priority to programmes like agriculture, community development irrigation, specially minor irrigation which spread over the entire area within the shortest possible time[13]. It is suggested in the Third Five Year Plan that a continuous study of economic trends and rates of growth in different areas is useful in formulating programmes for more balanced regional development. For assessing levels of development in different regions, indicators of development based on agricultural production, industrial production, investment, unemployment, electricity consumption, irrigated area, value of output by commodity producing sectors, level of consumption expenditure, road mileage, primary and secondary education and occupational distribution

of population are useful.[14] It is necessary to view development of regions and of the national economy as parts of a single process. The progress of the national economy will be reflected in the rate of growth realised by different regions and in turn, greater develepment of resources in the regions must contribute towards accelerating the rate of progress for the country as a whole.

A brief mention has been made about district planning in the Fourth Five Year Plan (1969-74) report. It is recognised that the success of the State plans depends on their formulation in relation to physical features and resources and the institutional organizations in each area. The requirements of development comprise of not only financial resources and material inputs but personnel and the right kind of institutions. This requirement has to be worked out for each operational area. The natural corollary of beginning to plan realistically and from the bottom is to recognise that planning is not something that comes from outside or above but what each state, district, locality and community does to develop its own resources and potentialities. This can be realised by diffusion of initiative, decision-making and participation. It will lead also to shouldering of responsibilities[15]. All suggestions for diffusion and growth of activity and employment involve detailed specific as also local planning and implementation. Some specific provisions have been made in this regard in the central sector under the fourth plan. In agriculture, schemes for area development planning and pilot schemes for helping small farmer economy in a number of states have been included in the central sector plans. There is also the inclusion of centrally sponsored scheme of rural industries projects. In some states experimentation in district or regional planning is already underway. It is expected that with successive annual plans, district planning in the states should become more general and detailed and coordinated programmes in various directions should be evolved. The planning commission has a responsibility in this regard. It should assist the states in the preparation and evaluation of individual projects and programmes and also in dealing with the overall problems of regional and district planning[16].

The state planning commission in its draft perspective plan has pointed out that decentralised planning is a powerful weapon for attacking mass poverty in the state. Under it the particular problems faced by each area can be assessed. It will be possible to find solution through the local mobilisation of resources both human and material. Target planning and central and state indicative programming must be supplemented and supported by planning from below[17].

It will be clear from the above analysis that one of the objectives of planned development in India is balanced regional development. Much emphasis has been on regional development in the various Five Year Plans. The region in the Indian context is to be viewed as the district. For it happens to be the unit of administration and the district administration is given the responsibility of implementing the programmes of development. The district is thus a programme or policy region and is homogeneous in being entirely under the jurisdiction of some one or a few specific government or administrative agencies. To find out whether there is balanced regional development it is essential to make a study of the district separately and see whether the growth rate there, is comparable to the average growth rate of the state in regard to the various important sectors.

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SOUTH INDIAN LITERATURE: A COMPARATIVE STUDY

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The Dravidian Languages numbering 22 or more constitute one of the important families of the world, ranking fifth or sixth in terms of number of speakers-being spoken in the Indian Subcontinent by approximately 120 million people. The Dravidian family of languages occupy a continuous area in the four southern states of Andhra Pradesh, Mysore, Tamil Nadu and Kerala where Telugu, Kannada, Tamil and Malayalam are spoken respectively. Among the four major Dravidian languages, Tamil is widely known and possesses the oldest and richest literary tradion. The origins of the Tamil Literature can be traced to the early centuries before Christ. Speakers of Tamil are also found in Ceylon, Burma, Malaysia, Vietnam, South Africa, Fiji islands, Mauritius and Trinidad. From the point of view of the number of Speakers Telugu occupies the first place among the Dravidian Languages and only next to Hindi in the Indian Union. It is mainly spoken in Andhra Pradesh and also in the bordering areas of Mysore, Tamil Nadu and Orissa. Telugu speakers are also found in Burma, Malaysia and Mauritius. The earliest Telugu Inscriptions are found from the sixth century A.D. while Literary works in Telugu date from the beginning of the 11th Century A.D. Kannada is mainly spoken in the state of Karnataka and inscriptions in Kannada date from 450 A.D. The Literary tradition in Kannada commences from the 9th Century A.D. Malayalam is spoken in the Kerala state and it has written records from 10th century A.D. Though these languages have come to stay in different times from the proto Dravidian, they have a common literary heritage and also certain distinct features of their own in contrast with each other. It is my endeavour in this paper to compare the Literatures of the four major South Indian Languages namely Tamil, Kannada, Telugu, and Malayalam. Among these Tamil has a rich Literary heritage for about 2500 years, the earliest extant work being Tolkappiam by Tolkappianar which is a work on Grammar and Literary theories of the Tamils. The Kaviraja marga of Nrpatunga, a Rashtrakuta king, is the earliest available work in Kannada which is also a work on Grammar and Poetics modelled after Dandin's Kavyadarsa. The translation of the first three parvas in Mahabharata by Nannaya is the earliest available work in Telugu. Kaviraja marga belongs to the 9th Century A.D. and hence has a Literary tradition of about one thousand two hundred years. Nannaya belongs to the 11th century A.D. and Telugu Literature is of about thousand years old. Ramacaritam of one Cīrāman is the available earliest work in Malayalam which belongs to the 12th century A.D. and its literature has a tradition of over eight hundred years. The order of the beginnings of these Literatures reveal that Tamil is the earliest among them, while Kannada, Telugu and Malayalam come next to it in succession. In each of these languages we have great poets of eminence, who, with their works of merit, have enriched the respective literatures. The anthologies of the Sangam period, Tirukkural; the twin epics Silappadigaram and Manimekhalai; the devotional poetry of Ālwars and Nāyanmars; Kambaramayanam, otherwise known as Ramavataram, are the major works in Tamil to be reckoned with. Pampa and Kumara Vyasa are two peaks in Kannada Literature. Pampa Bharata, the Vacana Literature of Basaveswara and other Veera Saiva saints, Kumāra Vyāsa Bharata, the Dāsara Padagaḷu, the lyrics of Dasa kūta poets, the sayings of Sarvagna are the beautiful medos in Kannada Literature. The Mahabharata of Kavitraya, Ranganadha Ramayana,

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Pothana's Bhagavatam, Manucaritra, Vasucaritra, Āmuktamālyada, and Pānduranga Māhātmyam of the Krishnadevaraya age, the Kaḷāpūrnodaya of Pingali Surana, Vemana's verses, the Lyrics of Tallapakam poets form the bed-rock of Telugu Literature. Exhuttaccan's Adhyatmaramayana, Krishnagātha of Cerusseri Nambudiri, the literary works of Niraṇam poets, the Attakkadha and Tullal Literature credit Malayalam with poetic eminence

Tamil - the most ancient:

Among the four major South Indian Languages, it is in Tamil that we find the most ancient literature. The Tolkappiam, the earliest extant work in Tamil, is said to belong to the 5th Century B. C. and it is contended on the strength of the grammatical treatise and also a few other factors, that there flourished some literature in Tamil rich in content and tradition before Tolkappiam to warrant such a work of grandeur which was perhaps lost to us. In the Sangam age that followed, there seemed to be a vigorous literary activity which resulted in compositions of a considerable number out of which only a few are available in the anthologies of Tamil like Pattupāttu, Ettuttogai and Padinenkiḷkaṇakku. Some of the works that were included in the anthologies are considered to belong to post Sangam age also by some and subsequently included and enumerated in them. The concepts like Agam and Puram are unique to Tamil Literature and the Literature of the Sangam period has its own characteristics independant of Sanskrit. In the twin epics, Silappadigāram and Manimēkhalai that followed, the poetry attained an epic grandeur. The greatness of Tirukkural cannot be ignored or ill-estimatedin as much as it is considered to be the Tamil Veda, the Veda of the Tamils. While we have some more works like Jeevakacintāmani, Cooḍāmani and Perumkadai etc., in the centuries that followed, the Literature that we find in the hymns of Saivite and Vaishnavite saints, the Ālwārs and Nāyanmārs, is remarkable and the metre Veruttam is said to have undergone experiments in these hymns to become a poetic medium later in the Kambarāmāyanam. In the Pallava period, Sanskrit had the royal patronage and as such Tamil literature also, in the period, began to come under its influence Tamil poets began to write poems as adaptations of the Sanskrit works even though they attempted at some originality in them. Kambar, Ottakkūttar and Jayamkonḍān were great poets whose contribution to Literature was immeasurable. The Literature that was produced under the patronage of the Saivite and Vaishnavite Maths is vast in quantity even though it fell in standards. In the modern period, with the advent of the British, there has taken place a change in the outlook and attitude of the people, much so in the poets and as a result the literature was marked with the change in theme, form, Language, and content. Poets like Rāmalingaswāmi, Subrahmanya Bharati, Bhāarati Dāsan and many others enriched the modern Tamil Literature in its magnitude.

Kannada Literature

We have evidence to the existence of Kannada Literature in as early as the 9th century itself. Kavirājamārga, a work on poetics on the model of Dandin's Kavyadarsa, said to have been written by Nrpatunga, the Rashtrakuta king of the 9th century, is the first available work in Kannada. It is presumed, as in the case with other languages also, that there flourished considerable Literature prior to Kavirajamarga on the basis of Kavirajamarga itself and also some later works. Pampa, Ponna and Ranna-the Ratnatraya as they are called-enriched the Literature in the subsequent two centuries and each has written a Dhārmikakāvya and a Laukikakāvya. The Dhārmike Kāvya is a poem which described the life and work of one of the 24 Tirthamkarās, the Jain Prophets, while the Laukikakāvya deals with other secular theme. Chavunḍarāya, the great ganga king, wrote a work in prose called 'Triṣaṣṭiśalākāpuruṣa mahāpurana,which is also called as Cavundarayapuraṇa. After the jains, the Veera Saivaits came into prominence and a vast Vacana Literature was produced in the Basava period. Basaveswara, Cennabasava, Allamaprabhu, Mahadevi Akka and many other saivite devotees sang in their vacanas on many subjects addressing their personal deities. In their Literature, we find the Sanskritic trend giving way to the desi or native trend. In the period that followed, though there were jain and veera saiva poets, majority of them sought to adapt Sanskrit works and rendered them in a very grand manner into Kannada. Gadagu Bhārata, Torave Rāmāyana, Jainini bhārata and the like were written during this peiod. During the three centuries 15th, 16th and 17th, the Vaishnavite devotees called Haridāsās like Kanakadāsa, Puramdaradāsa, Jagannādhadāsa composed hymns in praise of the various manifestations of Lord vishnu like Viṭṭala which were labelled as Dāsara-

padagalu and it had its own special characteristics. There were a few attempts in the earlier periods in Kannada to come out of the influence of Sanskrit in the matter of language and metre which resulted in having poems written in Ragaḷa, Satpadi and Sangatya. The Literature that flourished under the patronage of the Mysore kings deviated from the past to a great extent and once again Sanskrit regained its strength and began to dominate the Kannada Literature. Most of the sanskrit purāṇās were translated into Kannada during this period and modern prose has its roots in this period. The modern Literature in Kannada is varied in many respects and all the literary types were and are being explored to the fullest. Poets like B.M. Srikanṭaiah, Cunḍappa, Bendre, Puṭṭappa and many others are the flowers that blossomed in the garden of Modern Kannada poetry.

Telugu literature :

The Telugu literature had its beginning in Nannaya's Mahābhārata, the first available work in Telugu, which belonged to the 11th century. It is argued that much Literature might have flourished prior to this work to have such a magnificent poem, sound in all respects, on the strength of a few verses found in the inscriptions and also external evidence like references to folk songs in later works. The trinity of poets called Kavitraya in Telugu-Nannaya, Tikkana and Errāpraggada completed the translation of Mahabharata into Telugu and it took three centuries to have the complete translation of the great work of Vyâsa in Telugu by poets belonging to different times. While the later poets in Telugu followed the model of Nannaya in the composition of Poems as shown in his poem in form and language, the Veera saiva poets like Pālkuriki Sōmandha, in order to propagate their creed, took to different course both in respect of language and metre. They adopted the native metre, dvipada, and employed Jānu Tenugu which corresponds to centamiḷ. Poets like Bhāskara, Nācana Sōmana, Srīnādha tried to render the famous epics and poems found in Sanskrit in Campu style, the only exception being Ranganadha who wrote his poem Ranganadha ramayanam in dvipada, a native metre. Though the roots of the prabandha, a unique form of composition in Telugu, are traced even in the Kumarasambhava of Nannecōḍa and Nrsimhapurāṇam of Errana, it received maximum patronage and consideration in the times of Srikrishnadēvarāya who himself has written a poem of great merit called Āmuktamālyada. It is said that eight poets called Aṣṭadiggajās flourished in his court and his period was considered to be the golden age in the History of Telugu literature· Great poets like Allasāni Peddana, Mukku Timmana, Tenāli Rāmakrishna, Ayyalarāju Rāmabhadra, Madayagāri Mallana flourished in his court and composed poems which have become popular in the subsequent ages. The period of Sri Krishnadevaraya was otherwise called as the prabandha period because of the new literary form 'Prabandha' attempted by a good number of poets. Mention must be made here about Pingaḷi Sūrana, a later poet, in as much as he composed a poem called 'Kaḷāūrnōdayam' with an original theme which was uncommon in Telugu till then. The Southern school of Telugu Literature followed the Prabandha Period and the place of literary activity shifted to both Madura and Tanjavūr consequent on the fall of Vijayanagara at Rakshasatagadi otherwise known as Tallikōṭa. The poems that were written during this period were mostly erotic and a few Kshētra Māhātmyas were also written during this period. The poets showed considerable liberty in the usage and also in respect of grammar. We find a few women also taking to composition here. The stress was more on the style and Sabdacitra than on sentiment and the like. A new form Yakshagana and also Prose came into existence in this period. The 18th and 19th centuries were considered to be the age of decadence and the modern period started in the last quarter of the 19th century. Poets like Tirupati Venkata kavulu, Gurajāda Appa Rāo, Rayaprōlu Subbā Rāo, Srī Srī, and many others enriched the literature in the variety of forms and to-day Telugu is advancing in its full vigour with several literary forms like Lyric, Novel, Short Story Drama, one-act play, Radio play, Free Verse etc., which are being explored and experimented with by many a writer.

Malayalam literature :

Malayalam literature has its beginning in the 12th century in Rāmacaritam pāṭṭu of one Cīrāman. Even though the Literature in Malayalam started late in comparison to other South Indian Literatures, it possesses a rich heritage quite unique in

its own way. A few of the folk songs are said to be the compositions prior to Rāmacaritam pāṭṭu, but we cannot say it with any certainty. As Malayalam was influenced by Tamil in the earlier centuries and by Sanskrit later we have two kinds of Literature in it called pāṭṭu and Maṇipravāḷam. The Maṇipravāla style, though found in other languages in very meagre proportion, in Malayalam it has got unique characteristics of its own. The early Malayalam literature consists of a good number of Samdēśa Kāvyās and also campū Kāvyas written in Maṇipravāḷa style. It was a fashion in a certain period to compose a Samdēsa Kāvya if any one wanted to be recognised as a poet in the Malayalam society Cerusseri, in his Krishnagādha, attempted to employ a native metre like manjari in his work and wished to strike a contrast. The niraṇam poets enriched Malayalam with their works. Punam and others attempted at the Campū form of the poem and gave us good Campu Kāvyās like Campu rāmāyana. Ezhuttaccan is the father of the modern Malayalam and with him starts the modern period in Malayalam literature His Adhyatmaramayana and Bhagavatham and also other works are held in high esteem and especially his Ramayanam was till recently being worshipped and read with reverence in Kerala. He popularised the Kiḷippāṭṭu type of literary composition. In the 17th Century Kottarakkāra Tamburān took to the composition of Attakkathas which were written with mostly puranic themes to be made use of in the Kathakali performances. Tuḷḷal is another form of folk dance poem which came into existence due to the untiring efforts of Kunjan Nambiar. Tuḷḷal is a different form of folk art and it aimed at social reform also simultaneously in criticising sarcastically the social evils in public, in the guise of the stage actor. In the modern period, Vallathōl, Uḷḷur S. Parameswara Iyer, and Kumaran Āśan are held in high esteem for their meritorious services to literature and they are called the trinity of modern poets. Today the Malayalam literature is rich in all respects and is advancing with rapid speed quite in tune with the poetic and artistic experiments found in India and elsewhere.

Comparisons and contrasts :

On a general survey in outline of these four major literatures, we find a few comparisons and also contrasts in them. While the literatures in Kannada, Telugu and Malayalam were greatly influenced by sanskrit from the beginning, such influence is not there in Tamil in the early times excepting in the Pallava and the imperial Chōḷa periods. While there exists Jaina literatures both in Tamil and Kannada, such literature is not to be found in Telugu and Malayalam, the reason may be, by the time the literatures started in those languages, the particular religion became extinct in the regions due to the efforts of people belonging to the Saivite and Vaishnevite faiths. There is considerable amount of didactical literature in Tamil, Kannada and Telugu, but it is not the case with Malayalam. The attitude of the people and the social conditions that prevailed in Kerala might be the reason for the non-availability of such literature in that language. We have devotional literature in Tamil, Kannada and Telugu in the form of hymns of Saivite and Vaishnative devotees. We have no such literature in Malayalam, the reason being Ezhuttaccan's Ramayana itself is a poem and at the same time a piece of devotion to be chanted with reverence. Samdēsa Kāvyās are not there in the other three literatures as we find in abundance in Malayalam. Of course there is Tūdu in Tamil, and a few translations of Sanskrit Samdesa Kavyas in Telugu and Kannada and a very meagre number of original works in Telugu. But it did not form a branch of literature to be reckoned with in those languages. We have Yagshagānās in Tamil and Kannada modelled on the form evolved in Tanjore under the patronage of Tanjore Nāyak kings. The Attakkadha in Malayalam took the place of Yakshgana of the other languages. All the four literatures attempted to have the great sanskrit epics like Rāmāyaṇa, Bhārata and Bhāgavata and also poems rendered into their respective languanges, though the occurance of the rendering varied as to the circumstances prevailing in the languages. In the adaptations too, the poets of all the languages deviated from the original in some respects for the sake of characterization and such other reasons. The influence of English and other national and international languages is there in the modern literatures of all the languages. As there were no cultural barriers and differences based on religion and language in ancient times, the works in one language were being translated into other languages and shared the intellectual feast, feeling the oneness of culture and heritage. The great devotees of Saivite and Vaishnavite faiths belonged to all regions and their lives and activities were described at length in glorious

terms in all the literatures. Though Sanskrit metres were favoured in preference to indegeneous metres, there were attempts in Kannada, Telugu and Malayalam to employ the native metres also. Certain poets advocated their usage and succeded in their endeavour. Tamil did not favour the Sanskrit metres and employed only native metres. There was mutual influence of Tamil and Kannada, Telugu and Kannada, Telugu and Tamil and also Tamil and Malayalam.

The Vacana compositions of the siva saraṇās can be compared with the hymns in Tamil by the Saivite and Vaishnavite saints. Much resemblance can be seen between those compositions in these two languages. The influence of this kind of composition can very well be seen on the compositions of Krishnamacārya in Telugu which are said to belong to the next century (13th) to that of Basava (12th Century). His compositions are called Simhagiri Narahari Vacanamulu and are popularly known as Krishnamācārya Vacanamulu. Pedda Tirumalācārya of the Tāḷḷapākam family of Tirupati, which is famous for its musical compositions, composed Venkateswara Vacanamulu addressing each Vacana to Lord Venkateswara. they are also called Venkateswara Vacana Malikāgītālu.

Spread of cultures :

In ancient times there were no barriers based on language and region and the culture of one region freely moved to another region resulting in cultural diffusion that deserves a scientific and systematic study. The mutual influence of different cultures in South India was made easier because the Tamil region and the Kannada region were neighbours and continue to be so. Mysore was the ancient erumai Nāḍu of the Sangam age. The Gangās, the Cāḷukyās and Hoysalās were connected with the Tamil country by marriage alliances. The Jains of the Tamil region and Kannada region moved easily from one country to another. In the Hoysala period, the Hoysala king came to be described as Mamadi, the revered father-in-law of both the Pandyas and the Cōḷās. Both the Tamil and the Kannada regions came under the influence of Vijayanagar empire which flourished in Andhra Pradesh. The Chieftains of the Vijayanagar kings ruled over the Pānḍya and the Cōla regions as their viceroys with Madurai and Tanjore as their capitals for some time and Tamils came into contact with the Telugus that came from Andhra. Later, they came under the British empire. The diffusion of cultures at a deeper level is the influence of literature, religion and philosophy of one region on the other. The Bhakti cult, a contribution of the Tamils through their Saivite Nāyanmārs and Vaishnavite Āḻwārs spread to other regions of India and a few aspects of this cult are found in them also. The aspect of Bhakti cult such as ethical emphasis, social service as divine service, the negation of caste and other differences so as to glorify the saints of the so called lower caste Harijans etc are found in Andhra and Karnataka regions also. The Tamils had contacts with Andhra and Karnataka and also Maharastra through Cālukyan and Rastrakuta empires. The wandering saints of India also contributed much to the spreading of different cultures of the various regions. The vacanagaḷu of the veera Saiva saints of Kannada and the Padyamulu of Vemana are nothing but the echo of the compositions of Siddha like Sivavakkiar in Tamil. Though there is no direct borrowing, we find in them an evidence of an intellectual climate. Kambaramayana, the great Tamil epic, was equally popular both in Kannada region and Kerala region. A kannada inscription of the 14th century speaks of the exposition of Kamba Ramayana in a temple of Kerala region. The people of Kerala have deified Kamban and the tradition says that Siva was born as Kamban to fulfil the desire of Durga to witness the war between Rama and Ravana. It is curious that this Ramayana did not spread to Andhra till recently perhaps due to the long distance to cover or to the fact that they had their own translations of the great epic, popular among masses. It is a strange co-incidence that poems belonging to the same century i e. 12th century A. D. describing the lives of the sixty three saivite saints-Aruvattu Muvar - were written in Tamil, Telugu, and Kannada by Sekkilar, Palkuriki somana, and Harihara respectively. It seems that they narrated the stories as they were found in their respective regions and the similarities, differences in versions, the corruption of names of the saints may well be explained to the fact of their being drawn from the people. We find similarities in the hymns of the Vaishnavite ālwars and the Sankīrtanas of Tallapakam Annamacarya and others

of his family. As the Tallapākam poems embraced Vaishnavism in the times of Annamacārya (15th century) and the hymns of Vaishnavite Ālwars were being sung and explained at the Temple of Lord Venkateswara at Tirupati by Vaishnavite Ācārya-purushās, it is quite possible there are echo of the hymns of Vaishnavite Ālwars in their compositions. Some Telugu poets fascinated with the exemplary stories of Saivite Nāyanmārs and Vaishnavite ālwars have composed independant poems also with some of the themes. We have Nakkirar's story found in the Kalahastimahatmyamu of Dhurjati in Telugu which belongs to the 16th Century A. D. The dasa Vangmaya, a Vaishnavite musical literature in Kannada, has a resemblance with that of Vaishnavite ālwars in Tamil. Just as Sekkilar described the majestic and unworldly style, using high sounding Sanskrit words found in the age of Oitakkuttar and saved centamil for the use of common man in his Periapuraṇam, the Purana of the sixty three saints, so also pālkuriki Somana advocated the cause of Popular Telugu, called Janutelugu to be used in the Poems as against the Sanskritic Telugu. It corresponds to Jannudi of Kannada In selecting the metre for his poems also,he prefered Dvipada,an indegenous metre in preference to the Sanskritic metres favoured by his predecessors in Telugu. We find a striking similarity in Harihara's Sivaganara Ragaḷa in Kannada which also belongs to the same century. It described the stories of the Aruvattu Mūvaru in the indegenous metre called Ragaḍa.

Theocentric literature

On an examination of these literatures, we find a certain amount of Literature which centres round the Temple and the devotional Literature comes under Temple Literature. The Alwars and Nayanmar visited several shrines in South India and sang in praise of them. The places of worship, the presiding deities at the various shrines, the sacred rivers that flow by the side of those places, the tīrthās inspired many a poet and they poured out their devotion and reverence in their compositions. They sang their feelings and spiritual experiencets, described the grandeur of those places and rivers, and tried to manifest the grace of the presiding deities with illustrations of the devotees' lives. Several Sthalamāhatmyās have sprung up which describe in detail the the sacredness of those places, the exemplary lives of the devotees who attained mōksha at those places. Telugu is no exception to this general rule. The great temples at Tirupati, Kālahasti, Ahōbalam, Śrīśailam, Drākshārāmam, Srikākulam and Bhadrācalam were responsible for a considerable amount of literature in Telugu also While some of the poets sang in praise of the presiding deities in hymns and satakas, certain others have written poems in which they described everything about the place of worship. To quote a few hymns of Tallapakam poets on Lord Venkateswara, the Kalahastimahatmya, the Bhīmakhanda and Kāśikhanda, Pāṇḍurangamāhātmya, the works on Śrīśailam, Nrisimhapurāṇam, Bhadrācala Rāmadāsu Kīrtanalu and a good number of Satakas addressed to the presiding dieties at the places of worship, constitute a major part of literature. In kannada too we have pampa sataka and the like and also the vacanas of veerasaivite Saints form part of this kind of Literature The Temples were not only places of wroship only but also cultural centres where art and Literature flourished. The yakshagānās in Telugu, Kannada and Tamil, the Āttakkadhas and Tuḷḷals in Malayalam were the literary types shaped to be used in modes of entertainments that the temples offered at the time of annual festivals and festive occasions like Sivarātri, Tiruṅāḷ, Jātara etc, The Pada literature in Telugu, the compositions of the musical trinity Tyagayya, Swati Tirunal and Syama Sastri and the like also come under Temple literature in as much as they are composed and being used in arts connected with temples while works with the themes of our great epics like Rāmāyana, Bhārata, Bhāgavata and other puranas form a major part of these literatures, the Literature that flourished on and about the temple is considerably rich in many respects. The discussion above about the South Indian literatures will reveal that there was cultural diffusion among speakers of various languages in different regions and the themes that they have taken up for composition resulted in national integration, at the same time training the mind of the man towards universal brotherhood and spiritual excellence.

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A CRITICAL ANALYSIS OF THE INTERNAL AND EXTERNAL ASSESSMENT DONE IN THE TRAINING COLLEGES OF MADURAI KAMARAJ UNIVERSITY—A REPORT

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Reference Frame :

In recent years, assessment has come to replace test or examination and both internal and external assessments are advocated, the rationale being that different aspects of student growth should be assessed, the assessment should be continuous throughout the year, this should be done by various appropriate techniques with reference to the criteria and testing should be done by those who teach. This may be supplemented by an end examination conducted by an agent external to the institution and its students so as to establish comparability and certain uniformity of standards.

With the introduction of Semester System, all the graduate and undergraduate courses of Madurai Kamaraj University have been semesterised and 25 to 50% of the marks are allotted for internal assessment for the various courses at various levels. There have been serious misgivings about the reliability of the internal assessment marks.

In a study taken up by the Department of Education on the working of the Semester System, reported on 14th February, 1979 to the Academic Affairs Committee, the main reactions of the teachers and students of colleges towards internal assessment were as follows :

1) The teachers felt that there is no uniform norms for accurate appraisal of the students.

2) There is no uniformity in the practices of awarding marks among the various colleges and in the same college among the various departments.

3) The students felt that there is 'halo effect' in the awarding of internal marks and the so called 'good students' however badly they might have done a test, still continue to get the usual high marks.

4) Both teachers and students felt that there is no close relationship between internal and external marks.

To find the truth of some of the findings with respect to training colleges and find out how scientifically internal assessment is being done in the training colleges, Department of Education took up a critical analysis of the internal and external assessment marks of the B.Ed. programme (of the year 1977-78) of nine training colleges of Madurai Kamaraj University as a first step.

Design

Objectives :

The objectives of this study are

1) to analyse the internal and external marks obtained by the students of the training colleges in the three core papers.

2) to compute and analyse the agreement between the internal and external assessment marks in general and specific terms.

3) to analyse the number of I and II classes secured by the colleges in theory and practicals and

4) to find out the relationship between theory and practicals marks.

Sample :

The sample of the study comprises 711 regular students of nine teachers' training colleges affiliated to Madurai Kamaraj University, who appeared for the B.Ed degree examination, April, 1978.

Table 1. *Sample of the study*

Code No. of the Colleges	C1	C2	C3	C4	C5	C6	C7	C8	C9	T
No of students appeared	70	82	89	87	68	69	70	86	90	711

Papers Analysed :

The three core papers of B.Ed. degree examination April, 1978 analysed in this study were

Paper I Psychological Foundations of Education and Evaluation.

Paper II Philosophical and Sociological Foundations of Education.

Paper III Education in India

The other papers were not analysed since different colleges offer different' school subjects'

Tools/Techniques :

No tool was constructed for this study. Technique of correlation analysis was used besides the computation of percentages and measures of central tendency.

Method :

The information regarding the internal and external assessment marks of the students was collected from the University records with the kind permission of the concerning authorities. The following statistics were computed for the data for analysis : 1) Ranges 2) Modes 3) Correlations 4) Percentages, and Maximum and Minimum numbers. For convenience the nine colleges were coded as C1, C2, ... C9.

Analysis and Discussions

Table 2. Internal Assessment Marks awarded by the colleges in the three core papers (Maximum=25)

College	Paper I				Paper II				Paper III			
	Max.	Mini.	Range	Mode	Max.	Mini.	Range	Mode	Max.	Mini.	Range	Mode
C1	20	11	9	13	20	11	9	13	20	11	9	15
C2	19	13	6	16	19	13	6	17	20	12	8	16
C3	22	15	7	18	22	12	10	18	20	12	8	15
C4	18	11	7	14	17	12	5	14	19	12	7	14
C5	19	14	5	16	19	14	5	18	19	14	5	17
C6	20	15	5	17	20	14	6	16	20	15	5	17
C7	22	18	4	22	22	16	6	20	22	17	5	20
C8	20	14	6	18	20	14	6	15	22	12	10	20
C9	20	16	4	18	21	14	7	16	21	16	5	18

Table 3. External Marks obtained by the colleges in the three core papers (Maximum=75)

College	Paper I				Paper II				Paper III			
	Max.	Mini.	Range	Mode.	Max.	Mini.	Range.	Mode.	Max.	Mini.	Range	Mode.
C1	41	22	19	30	52	25	27	39	45	30	15	37
C2	45	15	30	30	44	12	32	30	51	14	37	34
C3	44	15	29	30	41	21	20	32	48	21	27	30
C4	43	15	28	31	39	13	26	39	52	21	31	37
C5	38	18	20	30	36	13	23	30	49	25	24	37
C6	43	26	17	34	41	20	21	30	46	30	16	34
C7	50	23	27	34	45	25	20	37	50	30	20	34
C8	43	22	21	30	41	23	18	30	44	30	14	34
C9	45	22	23	30	46	24	22	35	45	30	15	38

From table 2 and 3 it can be seen that the internal marks of all colleges in all the three papers range between 22/25 and 11/25 (10 being the minimum required to pass) i.e. 88% to 44%, and the range in external marks seems to be from 52/75 to 12/75 i.e. 65% to 15%. This shows that the internal examiners are relatively liberal and there seems to be bias in favour of the students.

2. On further analysis it has also been pointed that the high scoring students in internal assessment have not always been found to be the high scoring students in external assessment and conversely, the low scorers in internal assessment are not the low scorers in external. For example, all the students getting the maximum marks in internal i.e. 22/25 have not scored first class marks in the external. Those who have 11/25, have not been the ones getting fail marks in the external This proves the unreliability of the internal assessment marks, especially from the point of view of prediction.

3. An indepth analysis of each college shows that there seems to be no scientific or uniform scale on which the internal assessment has been made. Two colleges have maintained a five point scale, two, seven point scale and one, nine point scale and the other four do not seem to have any standard scale in paper I In paper II, two colleges have maintained a five point scale, one, sevenpoint scale and another nine point scale and the others no standard scale. In paper III four colleges have followed a five point scale, one, seven point scale and another nine point and the others no standard scale.

One college, C7 seems to be too liberal in awarding internal marks, the modes being 22, 20, and 20 in the three papers respectively. Does this mean that most of their students are first class - distinction students? External marks do not justify this stand. The colleges C1 and C4 seem to be relatively strict.

4. From Table 3, we can see that the maximum external marks for different colleges in paper I varies between 38 and 50, Paper II between 36 and 52 and in paper III between 44 and 52. The college C5 gets the least maximum of 38/75 and 36/75 in papers I and II, and seems to have done better in paper III. This could be interpreted as that paper I was the most difficult paper and paper III the least difficult or that paper III was most liberally corrected and paper I most strictly corrected.

The maximum and minimum mode marks in paper I are 34 and 30, Paper II 39 and 30 and paper III 38 and 30. The modes seem to vary within a short range. This may be attributed to the objective marking of the external examiners.

5. From Table 4. it can be seen that the correlation between internal and external marks range between −0.49 to 0.61 showing both extremes. Of the nine colleges there does not seem to be even one college which has substantial positive relationship between internal and external assessment in all papers. Four colleges seem to have substantial positive relationship between internal and external marks in two of the three papers. Similarly two colleges seem to have substantial negative relationship between internal and external marks in two of the three papers. It seems only 50% of the colleges have followed some criteria in making internal assessment.

Table 4: Correlation coefficients between internal and external marks.

College	C1	C2	C3	C4	C5	C6	C7	C8	C9
Paper I	0.19	0.47	−0.45	0.41	−0.36	0.57	0.27	0.32	0.13
Paper II	0.54	0.19	0.22	0.56	0.31	0.55	0 61	−0.45	0.18
Paper III	0.56	−0.49	−0.15	0.20	0.51	−0 07	0.49	−0.22	0.33

Table 5: Number of I and II classes in theory and practicals:

College	Theory I classes	Theory II classes	Practicals I classes	Practicals II classes	No. of students appeared
C1	7 (10.00)	44 (62.86)	13 (18.52)	57 (81.43)	70
C2	1 (1.22)	53 (64.63)	20 (24.39)	60 (73.17)	82
C3	6 (6.74)	44 (49.44)	23 (25.84)	66 (74.16)	89
C4	3 (3.45)	68 (78.16)	16 (18.39)	73 (83.91)	87
C5	1 (1.47)	43 (63.24)	20 (29.41)	48 (70.59)	68
C6	5 (7.52)	45 (65.22)	18 (26.09)	56 (81.16)	69
C7	11 (15.71)	46 (65 71)	18 (25.71)	52 (74.29)	70
C8	7 (8.14)	63 (73 26)	21 (24.42)	67 (77 91)	86
C9	6 (6 67)	63 (70.00)	21 (23.33)	69 (76.67)	90

6. The number of students getting first and second classes in theory and practicals was analysed to find out the relationship between theory and practicals marks. In theory, C7 gets the highest percentage of I classes (15.71%) as expected as the total marks of internal and external are considered for awarding of classes, and we have already pointed out C7 has been liberal in awarding internal marks. C2 and C5 have got the lowest percentage of first classes.

C5 which has got the lowest number of first classes in theory and which has got the lowest maximum marks in paper I and II in the external assessment has got the highest percentage of I classes in practicals (29.41%) C2 which has also got the lowest percentage of I classes (1%) in theory has got 24.39% of first classes in practicals. This shows that there is little relationship between theory and practicals assessments.

If we analyse the pass percentage of theory and practicals, we see that there has been cent per cent passes in practicals and the failure rate of the colleges in theory ranges from 44% to 18%, C3 having the maximum failures and C7 having the minimum failures.

C4 and C8 seem to have high percentages of candidates passing in II classes both in theory and in practicals, their failure percentage being 18.5% in theory papers. Practical marks are merely mainly internal assessment, the external commission appointed mostly to decide the border line cases for first classes.

Hence we may conclude that of the nine colleges studied not more than two colleges may be said to have some good relationship between practical assessment marks and theory marks.

Findings

1) It can be stated that in general, internal assessment marks in all colleges are rather liberal, some colleges being too liberal and in the same college, some teachers are more liberal than the others. There seems to be a bias in favour of the students.

2) Different colleges maintained different scales, ranging from four point to ten point and in the same college, different scales being used for the different courses by the respective teachers and some colleges not adhering to any particular scale. Thus there seems to be no sound uniform criteria on which the internal assessments are being made.

3) High scoring students in internal assessment have not always been found to be high scoring students in the external and conversely low internal scorers are not always the low external scorers, proving the unreliablity of internal assessment.

4) Only four of the nine colleges have maintained a substantially positive relationship between internal and external assessment marks at least in two of the three papers, and two colleges have maintained substantially negative relationship between internal and external marks in two of the three papers, thus confirming that the teachers have not followed any sound criteria in awarding internal assessment marks.

5) Of the nine colleges studied not more than two colleges may be said to have some good relationship between practical assessment marks and theory marks.

Conslusion :

The training colleges and the teacher educators who should play a greater role in the examination reform movement, who should induct the serving and the future teachers in objective assessment of performance should take care to evolve sound uniform criteria for internal assessment within the college as well as among all the colleges of education and thus be in a position to direct and guide the Arts and Science colleges affiliated to the University in practicing assessment procedures scientifically and objectively.

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KARMA AND REBIRTH

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ABSTRACT

Most of the schools of Indian thought accept the theory of Karma and Rebirth. It is accepted that one is born with the impressions of the knowledge of the previous life. What is knowledge from the point of view of a philosophy student? What is nature of the person who attained knowledge? The present article analyses the answer of the questions posited above.

Karma :

Almost all the schools of Indian philosophy accept the doctrine of *Karma* and Rebirth. The word *Karma* derived from the root *Kr* meaning to act, to do etc. The Philosophers define *Karma* as the law of action. In the *Vedas* the *Karma* is used in the sense of ritualistic worship. Krisnna advises Arjuna to do his work without attachment, for a man who does his work without attachment attains supreme, knowledge and also reminds Arjuna that one should not abandon one's duty which attaches to him from his very birth. A man at any time is the sum total of the results of his previous thoughts and action and at every moment he is the builder of his own future. *Karma* stands for every mode of activity, and it helps one to purify ones mind and it will help to attain knowledge in turn.

Advaita Vedanta distinguishes three kinds of *Karma* :

1. *Sañctia Karma,* the seeds of destiny already stored as a result of former acts which will generate in time.

2. *Āgamikarma,* the seeds that would normally collect if one were to continue in the path of ignorance in the present life.

3. *Prārabdha Karma,* the *karma* bearing fruit in the shape of acutual events incidental to our present biography which will continue to shape the present existence until its close.

The past continues into the present, the present continues into the future. Amina Sengupta says "Hereditary tendencies cannot explain why a man is born to a particular environment. This "Why" becomes intelligible to us only when we believe that a man is born in a particular setting because he has to reap the fruits of his actions of previous lives. In other words it is the law of *Karma* that can give us at least a satisfactory explanation regarding the "Why" of the origin of life.

Worldly life :

In almost all the Hindu philosophies there is seen the constant repetition of the fact that material life is not of primary importance and death does not mean the final release of the soul. It teaches that discriminative wisdom will result in liberation which is the eternal release from the material life. The *Sāṁkhya* Philosophy recognises two ultimate realities matter and spirit. The two exist, independently of each other although matter acts unconciously for the liberation of the spirit. However, discriminative knowledge which is absolute and unmixed with error will remove false knowledge and the miseries of birth and death. Thus knowledge is the main reason for liberation and that could be achieved only by hard work. As soon as one acquires knowledge he attains liberation and thereafter the effects of this former actions have no influence on him. The process of death and birth goes on for ever until perfect knowledge is attained. *Bhagavad gītā* says "As a man discarding worn-out clothes takes other new ones, likewise the embodied soul casting off worn-out bodies enters into others."

Sânkara says the world is illusion and there is nothing worthy of pursuit in empirical life. Once we

know the world is unreal there is no need for us to take interest in worldly life. He insists on redemption from the world and not of it He does not demand a cnange of this world, but exhorts us to escape from it. Illness and death come, if not today then tomorrow, to ourself and those whom we love, and nothing remains of all we love on earn but dust and ashes, the futlity of the worldly life is indicated in the story of the traveller. A traveller, to save himself from the beast, that is persuing him, jumps to the well, where there is no water. In the well he finds a dragon with its jaws open to devour him. He cannot get out of the well, for fear of the beast, and cannot stay there for fear of the dragon. He is in a way between the devil and sea. He gets tired and feels that he will perish soon. When he tries to climb up catching the world plant he finds two mice gnawing the trunk of the wild plant. Though death awaits him on either side he holds on to the plant. It will soon give way and break off and the traveller cannot escape from the jaws of death. Even so, the people who travelling on the circuit of *Samsāra* know the pitfalls of their life. Therefore he says the people to free ourselves from attachment doing *karma* which will help to attain knowledge inturn. Purification of the mind is a necessary prerequisite for spiritual realization.

There are countless passages in the *upaniṣads* to declare that the world is nothing but *māyā* or illusion and the Brahman is real. Once the knowledge is attained *avidyā* disappears as the misconception of snake disappears on the perception of the rope. *Saṁsarva* ceases to exist on attaining *mukti*. The cause of pain is simply the error of false knowledge and with deliverance from error comes liberation from pain.

Liberated Soul or Jīvanmukta :

One does not give up one's body immediately after the perfect knowledge is attained. Life lingers on, for a considerable time just like the motion of the potter's wheel which continues to rotate even after the potter's action has stopped, and stops only when the energy is exhausted. It is the state of *Jīvanmukti*. A *Jīvanmukta* continues to exist in this physical form, though *karma* i. e. the accumulated *karma*, which has borne fruit in the shape of the present body and its inevitable experience of pleasure and pain, forms the obstacle to the abandonment of the body. The deeds done by one must be atoned for and for that purpose the *Jīvanmukta* retains the body till the *prārabdhkarma* is exhausted.

A general idea of the *Jīvanmukta* is given in the *Brahadāraṇyokopaniṣad* when one has become disgusted with the state of childhood and with learning he becomes an ascetic or a *muni* and when he has become disgusted both with the non-ascetic and the ascetic state he becomes Brahman or a *Jñāni* and the very man enjoys the integral experience even in the midst of his apparent activities in the world The *Bagavad gītā* describes this blessed state of the *mukta* as 'the day' which is but 'a might' to the undelivered, worldlings, meaning that the latter are shut out from the vision of the world as the manifestation of God. The *mukta* hates no living being and his attitude towards the entire world is friendly and compassionate. The *mukta* will no longer be affected by the afflictions of the mind and body and his self stands liberated, thus free from all pains and sufferings. What the *Jīvanmukta* does is, not to be called *Karma*. Strictly speaking, the activity of the liberated soul for the world solidarity is not *Karma*. Sporting in self delighting in self and daily acts, he is the best of those who know Brahma. *Mundakopaniṣad* says. When one attains knowledge no fundamental change takes place in him only his outlook undergoes a change, the dismisses the superimposed wrong notions about himself. Wisdom is therefore, the realization of freedom by direct experience of the true nature of thing and is the only means of getting out of all specific forms of existence. Viñjānabhksu says that the discriminatory spritual realisation of the nature of the self as distinguished from the non-self, serves to destroy all traces of egotism in the form of agentship and the like. As a result the consequent modes of passion, aversion, demerit, and the like cease to be generated. The formerly generated actions being burnt out due to the extermination of their concomitant attachment, ignorance and the like, are rendered sterile. (Those actions which have already been *fertilising* attachment would be exhausted with the end of the present life span.) The possibility of rebirth being thus precluded, there would ensue the state of final emancipation in the form of full and final elimination of all the miseries.

Another reason for the body to keep alive even after attaining knowledge is to transmit the knowledge to others If wisdom and death were simultaneous there will be no one to pass the wisdom on to others and with the first wise man, his wisdom would be buried. Without the teacher and his instruction mere activities however correct according to the scripures, will never lead to salvation.

Indian thoughts which are all based on the concept of *vāsana* and *Saṅdskāras*, have the doctrine of r ebirth essential to them. This doctrine is not only only organic to the Indian spirituality but is also its distinctive characteristic. The Law of *Karma*, simply stated, is that the consequences of the act are inherent in the act. A man's desire carries him to the objects of his desire which determine the field of his activity. His thought is a creative power and he becomes that which he thinks. His future circumstances are made by his present actions.

Nothing in this world is uncaused. The present existence is the effect of the past and the future is of the present binding one to the wheel of *Saṁsāra*. Clay is the cause of its effect pot. The law of *Karma* and rebirth is relaled to the cause and effect in Indian thought.

Subtloe body aud transmigration :

The law of *Karma* is related to the doctrine of rebirth through the doctrine of the subtle body, the soul which could not attain knowledge takes the cycle of birth and death. Association of the body and the Spirit is birth and the disassonation of this is death. How does this take another birth without losing its characteristics? It is through the sublte body. Both the *Sāṁkhyas* and the *Advaita vedāntins* are agreed in accepting the necessity of a subtle body in order to make the process of migration after one's death.

The term subtle means "hard to perceive". The subtle body acts as a vehicle for the journey of the soul from existence to existence. It is the body without any restrictions in its movements and migrate through existence from the first evolution to the final dissolution. It has the ability to survive and go throug all the fourteen words. "According to *the sāṁkhya* Philosophy nature evolved into intellect and from that ten organs and ten *tanmātars*." Subtle body is the from which included *Mahat*, *Ahaṁkāra*, ten organs and five subtle elements thus totalling seventeen entities. The subtle body is permanent whether it is found in the world of animals, of men, or of Gods, and it does not encounter any obstacles in its passage through mountans, rocks, walls, etc. because of its subtlety.

The *Sāṁkhya*, like the *Advaita Vedānta*, gives more importance to the belief in *Karma*. The deeds, once done can never cease at the time of death. It produce effect after effect, both in this life and the life to come. The condition causes the transmigration of the soul to new one, while the rebirth in turn brings with it a renewed development of the condition. The wheel of transmigration goes on its endless course with the subtle body which carries the virtues and vices unless and until the soul is able to find its means of release. It may be concluded that there is a strict correspondence between the cause and effect. The same principle may pass through different orders of existence and inhabit different worlds in succession.

For the question that may likely to be posted regarding the propriety of the subtle body remaining in the world after the death of the physical body ready to receive another body with the impressions of the previous one, it is said that the subtle body is connected with the will and hence it is possible for it to have the impressions of the previous birth as in the case of a piece of cloth which becomes invested with fragrance of the jasmine flower with which it has had contact earlier.

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THE ROLE OF QUEENS IN CILAPPATIKARAM AN ANALYSIS

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ABSTRACT

Cilappatikāram gives details about the three famous Tamil Kings-Cēra; Chōḻā and Pāṇtya. It also hints about how in those days the queens took part in politics and also served as advisers to Kings at times. In this paper an attempt is being made to explain the circumstances in which the queens played a vital role in Cilappatikāram with special reference to the cause of events that formed the basis and future currents of the core story.

Introduction

Cilappatikāram has been divided into three cantos namely Pukārkkandam, Maturaikkandam and Vanchikkandam. Elango Adigal, the author of this great epic, introduces Pandimadevi, the wife of Pandiyan Neṭuñceliyan in Maturaicanto and Ceramadevi the wife of Cheran Ceṅkuṭṭuvan in Vanchicanto. But he never introduces Cholamadēvi, either directly or indirectly through the conversation of other characters in any place in Cilappatikāram. We find in Maturaicanto the name of Pandimadevi being related with the anklet which is reported missing from the palace. This anklet which is reported missing from the palace. This anklet becomes the core of the story, which also elevates the position of Kaṇṇaki to that of a worshipable deity at a later stage. Here we see Pandimadevi's character being closely linked with the story.

In Vanchicanto Cēramadevi advises the King about the divinely nature of both Kaṇṇaki and Pandimadevi and requests to make arrangements for the worship of Kaṇṇaki as a deity. On her words Cēran Ceṅkuṭṭuvan set Northward with his forces to Himalayas to bring a stone to carve the image of Kaṇṇaki. Here also we see the character of Cēramadevi being closely linked with the story.

Pandima Devi :

Pandima Devi is the wife of Pandian Neṭuñceliyan. Elango Adigal attributes several names to her "Kopperun Devi"[1] "Puraideer Devi"[2]. Dr. V. SP. Manickam comments her quality as follows in his book "Endacchilampu", " If we think that Queen's anklet only leads and gives the name Cilappatikāram to Elango Adigal, the epic will become down? No. She is a woman of chastity like a great King"[3].

Dr. V.SP. Manickam explains her personality and opines that only her anklet gives the title of Cilappatkiaram to the author If there is no anklet missing then the spirit of the whole epic is lost and no fame would attach to Kaṇṇaki. Likewise, on the other hand, if Kaṇṇaki had not chosen to part with her anklet for sale naturally there would have been no killing of Kōvalaṉ and no emergence of "pattini worship" in Vanchicanto. The two anklets (that of Kaṇṇaki's and Pandimadevi's) play vital function in the epic. Hence we can conclude that it is the Queen's anklet that brings name to Kaṇṇaki rather than her own anklet.

It is very important to explain how the missing anklet is the cause of worship of Kaṇṇaki as a deity. Pandima Devi and Pandian Neṭuñceliyan were at the palace concert hall enjoying dancing. "There the great queen imagining that the king's heart had been won by the graceful appearance of Madura dancing girls who sang different songs, and displayed the wealth of their instrumental music in their dances hid her jealousy in a love quarrel and feigning a headaehe left him"[4]. Seeing the highly absorbed state of the King in the dance

and the song of the dancing girls, she became jealous and left to her private chamber.

Pandian Netuñceliyan noticing the indifferent mood of his wife rose from the seat to accompany her in order to please her. At this moment, the Goldsmith came and reported to the King that "the thief who used neither crow-bar nor auger but relied on the strength of sleep-giving incantations put to sleep the watchman at the gate before stealing the palace anklet, is now staying in my lowly little hut hiding himself from the watch-man ot this bustling city"[5]. On the report of the Goldsmith, the King ordered his men "Now if you find the foot ornament of my consort resembl-ing the flower-garland in the possession of an expert thief, kill him, and bring the anklet here".[6]

We can justify the action of Pandian Neuñ-celiyan for the news of tracing oı the Queen's anklet would change her indifferent mood and make her happy. Commentator Venkatasamy Nattar writes that "It will act as a medicine for his Devi's 'udal', if he ordered to bring the anklet."[12]

Pandima Devi and Kannaki in their sleep experience bad-dreams. In Pukarcanto, Kannaki narrates the dream to her attendant Teventhi. "In that dream she and her husband visit a big city and the city people treat them in an un-justifiable manner. They accuse Kovalan of having committed some crime. On hearing this Kannaki pleads before the King that her husband is guilt-less and further states that the King and the City will soon be in some trouble".[13]. Like this Pandima Devi in her own words narrates her dream to her attendant,

> "Alas! I saw, I saw (in my dream) the sceptre fall and the umbrella. The bell at the palace-gate shook itself and tinkled as it quaked. Alas! I also saw, I saw the eight cardinal points agitated; and darkness swallowed the Sun.
>
> Alas! I also saw an iridiscent rainbow in the Night; a meteor glowing with heat fell by day Alas".[7]

Pandima Devi also told the King about her bad dream and advised him to be cautious in his actions.[14] But the King had no time to listen and act on her advise. At that time Kannaki appeared before him pleading her case.

Here we see the good nature of Pandima Devi She wants to save the King and the city of Madurai But time is not favourable to her. This is called the time of 'ūlvinai'.

As Kannaki argues with the king we see the dreamof Pandima Devi come true. Kannaki's dream also comes true in Alarpadu Katai. Padima Devi relating her dream asked the King to save the city of Madurai. Kannaki did not say anything about her dream to her husband Kōvalañ and and also there was no chance for her to do so. Though both Kannaki and Pandima Devi foresee their future ills befalling on them, they could not divert the course of their destiny

In ancient days chastity was considered to fall into three categories. Woman of high chastity died as soon as she heard the news of the death of her husband and this was termed "Thalaikarpu". Another custom was the self-immolation of a woman on the death of her husband which is otherwise known as "Edaikkarpu" also called "sati". The third kind was the secluded living of a widow - 'kaimai nonbu", termed "Kadaikkarpu". When the King fell down from his royal throne Pandima Devi too suddenly collapsed and died saying :

> "It is impossible for woman to replace the loss of a husband! worshiping both his feet, she fell down"[8]

serving as an example to "Thalaikkarpu".

In Puranānūru we have an example for the "Edaikkarpu". The Pandima Devi, the wife of 'Ollaiyur thanta pūtappantian' when she heard the news of the death of her husband in the war she arranges for her 'sati'. But the people and the scholars protest and request the Queen not to do so. Not-withstanding their requests she enters into a column of fire and dies".[15]

Cērama Devi :

Cērama Devi is the wife of Cēran Ceṅkuttuvan. Elango Adigal gives her name as "Elango venmal". When Cēran Ceṅkuttuvan goes out to see the hill area of his country she accompanies him. Elango describes her appearance "Elango venmal utanirunthruli"[16]. The word 'utanirunthruli" means

'powerful adviser who gives suggestion whenever needed by the king'.

She speaks only a few sentences in Vanchicanto. These few sentences prove her an able adviser to the King.

Cēran, his wife and his sentries stayed in a hill area. There 'kuṟavar' - people living in the hill area, said "we have been your slaves for seven generations. Long live your powers! Under the forest vēṉkai tree a lady with a breast plucked out, suffered unequalled distress; but celebrated by celestials she ascended to Heaven".[9]

The King gathers more information about Kaṇṇaki and the destruction of Maturai and other related events. Tamil scholar Sāttaṉ explains to the King everything done in Maturai. The King turns to his wife and says "one chaste lady lost her life in peace when her husband died. The other in wrath came to our kindom. Of these two, ofascinating lady speak who is better?[10]

The great Cēramadevi replied Let the Queen whose soul departed before she experienced the agony of surviving her husband, enjoy the great bliss of Heaven!' And let this goddess of chastity who has come to our extensive country be duly honoured."[11]

The King accepted her views and decided to march northward to bring a stone for 'pattini worship'. We find here Cēramadevi's role helping the story to continue further to Vanchicanto without any hinderance. If she would have answered negatively there would have been no war with Northern Kings and no 'pattini worship' in the South.

As a comparative aspect of these three Queens, we find that the Cholamadevi is an unimportant character to the epic. And so Elango Adigal does not want to speak of her in the epic. Pandima Devi's anklet gives fame to Kaṇṇaki. She is a future-knowing figure in the epic. She is an able adviser to the King. She is an example of "Thalaikkarpu". Cēramadevi acts as suggester and an adviser. Her acts will help to march and fight ~~with Northern~~ Kings. Among the three, the great Pandima Devi's role is better than other two characters in the epic.

Acknowledgements

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INFLUENECE OF FIXATIVES ON LEUKOCYTE PHOSPHATASE ACTIVITY - SEMIQUANTITATIVE ASSESSMENT

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SYNOPSIS

Influence of fixatives such as 60% citrate buffered acetone, cold 10% formalin in methanol, cold acetone, cold methanol, cold ethanol and cold 10% neutral formalin on human leukocyte phosphatase activity has been studied semiquantitatively. On the basis of scoring of phosphatase activity, cold 10% formalin in methanol was found to be best of fixatives studied for the fixation of blood smears at least in case of alkaline phosphatase activity while blood films fixed in citrate-buffered acetone showed maximum activity of acid phosphatase. Merits and demerits of all these fixatives in terms of semiquantitative assessment of these enzymes have been demonstrated Further more pattern of scanning and scoring of the cells for enzyme activity has been included.

Introduction

Kay (1929) was the first to demonstrate the presence of phosphatase within human leukocytes. This earlier method involved the separation of leukocytes followed by usual process of biochemical assay procedure after the lysis of leukocytes. About a decade ago, independant work of Takamatsu (1939) and Gomori (1939) showed the demonstration of phosphatase activity inside the cell by means of histochemical method which is popularly known as metal-salt technique. Afterwards, Menten *et al* (1944) improved the cytochemical technique for assaying these lysosomal enzymes by introducting azodye coupling method and finally Kaplow (1955) not only introduced the diazonium salt in the method, but also made it semiquantitative. Later, Kaplow (1965) demonstrated the leukocyte alkaline phosphatase by means of the semiquantitative method. Similarly Burstone (1958) and Kaplow and Burstone (1964) presented the method for determining acid phosphatase activity of hematopoietic cells using azo dye techniques although the enzyme was first demonstrated in blood cells by the cytochemical method by Licy *et al* in 1970. Since these enzymes are involved in many physiological and pathogenic functions of cells, the importance of semiquantitative estimation of these enzymes cannot be ruled out, especially towards the role of fixatives for assaying these enzymes. But literatures on this particular direction and the semiquantitative assessment of these enzymes among Indian normal populations as well, appear fragmentary and scanty, hence the present investigation has been designed to find out the role of different fixatives on the phosphatase activity and their normal range among Indian people.

Material and Methods

Twenty five clinically healthy male subjects having more or less same socio-economic status and age group were selected for the present investigation. Each subject was repeated at least for six times and results have been expressed on average basis. After briefly fixing the smears by a suitable fixative, slides were incubated in presence of naphthol AS-MX phosphate substrate. As a result of the phosphatase activity, naphthol AS-MX is liberated and immediately coupled with the diazonium salt, thus forming an insoluble pigment at the site of enzyme activity and these pigments are microscopically visible. For the assay of acid phosphatase activity, the method as described by Kaplow and Burstone (1964) was followed with slight modifications while in case of alkaline phosphatase the procedure that was adopted in this experiment was essentially that as outlined by Ackermann (1962) with some modifications. The actual procedures are described below.

Types of fixative used: For assay of phosphatase activity both fixed and non-fixed blood smears were used. Following fixatives were used for the assay method:

1 60% citrate-buffered acetone (final pHof the solution 4.2).

2 Cold 10% formalin in methanol.

3 Cold acetone

4 Cold methanol

5 Cold ethanol

6 Cold 10% neutral formalin.

Fixation Technique :

Dry blood smear was immersed in fixative at room temperature for 20-20 seconds followed by thorough but gentle rinsing in water for 10-20 seconds. Afterwards the slides were air dried.

Assay of Acid Phosphatase activity :

Blood smears were incubated at 37°C for 2 hours in presence of 5 mg of naphthol AS-MX phosphate and 25 mg fast blue RR salt and pH of the incubating medium was 5.2 After the expiry of incubation period, the slides were taken out and washed gently with water followed by counterstaining with Mayer's haematoxylin. Again, slides were washed in water for 20 seconds and then allowed to dry in air.

Assay of Alkaline Phosphatase Activity :

Fixed or unfixed slides incubated at room temperature for 30 mins. in presence of naphthol AS-MX phosphate (0.25% W/V) and 25 mg fast blue RR salt and pH of the dye mixture was 8.6. After the incubation, the slides were washed gently with tap water followed by counter staining with Mayer's haematoxilin. Afterwards, slides were briefly washed in tap water and dried in air.

Method of Scanning and Scoring :

Unmounted slides were proceeded for rating. A thin area where erythrocytes were hardly touching each other was selected for scanning. Sites of leukocyte phosphatase activity (LPA) would appear as blue due to the fast blue RR salt. 100 consecutive segmented and band form neutrophilic granulocytes were selected and rating from 0 to 44 was given on the basis of quantity and intensity of precipitated dye that was found inside the cytoplasm of the cells. Detailed characteristics of scoring are shown in Table-1. and this represents the modified observations as stated by Kaplow (1955 and 1965).

Interpretation: The sum of ratings of 100 cells is regarded as the score like below:

$$RXN = S$$

where R = Cell rating

N = Number of cells counted

and S = total LPA score.

Details are given in Table-2. Finally, all the figures obtained in 'S' are added together to have the total score of LPA of the subject.

Results and Discussion

Table-3 shows the effect of different fixatives on the leukocyte phosphatase activity. The activity of alkaline phosphatase and acid phosphatase differ according to the fixatives used. Maximum activity of LAP (Leukocyte Acid Phosphatase) was found in smears fixed in 60% citrate-buffer acetone (pH 4.2) where the score was 85 and the medium activity was observed in smears fixed with cold 10%, neutral formalin. When the enzyme activity was expressed in terms of percent (maximum activity as 100) it was found that except 60% citrate buffered acetone (pH 4.2) and unfixed slides, the activity was always below 50 or nearly 50 in case of all other fixatives. Table-3 further illustrates the activity of leukocyte alkaline phosphatase. In case of this enzyme, cold 10% formalin in methanol which was comparatively not a better fixative of acid phosphatase, appeared as the best fixative for alkaline phosphatase activity (87) followed by 60% citrate buffered acetone (pH 4.2). Althoug the score of the unfixed smears was 72, but its results were not as good as when compared to cold 10% formalin or 60% citrate-buffered acetone (pH 4.2). But in case of acid phosphatase unfixed slides yielded satisfactory activity which was more or less like the slides fixed in 60% citrate-buffered-acetone. Besides these two fixatives (buffered acetone and cold formalin in methanol) and unfixed smears, rest of the fixatives like cold acetone, cold methanol, cold ethanol and cold 10% neutral formalin showed poor activity of the enzyme and in all the cases, percent of activity were below 50 taking cold 10% formalin in methanol as 100.

Among all the fixatives used in the present investigation-cold acetone, cold methanol, cold ethanol and cold 10% neutral formalin are commonly applied as fixative to various type of histochemical techniques in different types of tissues including blood. Though cold 10% neutral formalin has been recognised as a good fixative especially for the routine histopathological study, yet as a fixative for phosphatase activity of leukocytes, has been found to be least efficient. 60% citrate buffered acetone appeared as a good fixative for both the enzymes. This fixative not only maintained the cellular morphology but also effectively preserved the enzyme activity. The only difficulty which was encountered with this fixative was in recognising eosinophils which sometimes confused with neutrophils since they remained as unstained cells. If this fixative is employed in cold condition, significant amount of erythrocyte lysis was observed. Otherwise, this fixative behaved satisfactorily even it minimised the tendency for smears to wash off the slides. This tendency during staining is frequently observed in slides, fixed in cold 10% formalin in methanol. Same difficulty is also encountered with unfixed slides, otherwise, unfixed slides also yield a good result for alkaline and acid phosphatases.

Table I Scoring characteristics for LPA

Sl. No.	Cell Rating	Azo-dye precipitation in cytoplasm: Volume of cytoplasm occupied by azo dye precipitation (percent)	Visual size of the granule	Intensity of staining	Colour of background cytoplasm
1	0	Nil	Nil	Nil	Pale blue
2	1+	50	Small	Faint to moderate	Pale blue
3	2+	40-80	Small to Medium	Moderate to strong	Pale blue
4	3+	80-100	Medium to large	Strong	Faint blue
5	4+	100	Medium to large	Brilliant	Not visible

Table-II Method to obtain Total score

Sl.	Cell rating (R)	Number of Cells counted (N)	Total LPA score (S)
1	0	50	0
2	1+	25	25
3	2+	18	36
4	3+	6	18
5	4+	1	4
	Total	100	83

Table-III Effect of different fixatives on Leukocyte phosphatase activity

Sl.	Type of fixative	Leukocyte phosphatase activity: Acid phosphatase: Score	Percent of activity	Alkaline Phosphatase: Score	Percent of activity
1	60% citrate buffered acetone (pH 4.2)	85	100	78	67.86
2	Unfixed smears	83	97.64	72	62.64
3	Cold 10% formalin in methanol	57	48.45	87	100
4	Cold acetone	52	42.20	48	41.76
5	Cold methanol	59	50.15	50	43.56
6	Cold ethanol	48	40.80	54	43.74
7	Cold 10% Neutral formalin	45	38.25	39	33.93

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ON A COLLECTION OF ALGAE FROM MADURAI

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Introduction

Our knowledge of the algal flora of Tamil Nadu is mostly due to the pioneering work of Prof. M.O.P. Iyengar and his collaborators. A careful study of the contributions of Iyengar and others will reveal that these studies were confined essentially to the city of Madras and its immediate neighbourhood, and as such not much phycological work had been undertaken in the southern districts of Tamil Nadu. The present paper records the algae collected from some ponds and lakes in and around Madurai city. This inventory of the algal flora of Madurai is part of a long term research project entitled 'A Study of Biological Productivity in some tropical lakes of South India', funded by P.L. 480 - Smithsonian Research Foundation, U. S. A. In this paper, species belonging to the Class Cyanophyceae and the Order Chlorococcales of the Class Chlorophyceae alone are reported. Algae belonging to the remaining orders and classes will be dealt with in detail elsewhere.

Description of the area under study :

The area covered under the present study has a radius of about 20 kilometres with the Madurai University campus as the centre; and it lies at N.S. 78°.0' and E.W. 10°.50'. The chosen area includes almost all sub-habitats of the aquatic type. The Vaigai river and irrigation canals associated with it form the lotic habitat. Two large irrigation lakes and several temporary and permanent ponds form the lentic habitats studied. Again, a full range from relatively unpolluted to highly polluted habitats are also observed in the area of study, the polluting agents being of different types in different places.

Physiographically, the area chosen can be termed a plain with a few small hills here and there. The altitude of the region varies between 250 and 500 metres above mean sea level. The small hills reach a maximum height of about 300 metres and support a scrub-jungle type of vegetation. The soil of this region is the characteristic red or ferruginous type. About half the area under the present study is under cultivation. Annual rainfall ranges between 35 and 45 cms. During summer months, the temperature reaches a maximum of about 40°C and falls to about 19°C during the cold season.

In the present paper, 3 different areas have been covered within the chosen range. They are -1). Thirupparankuntram area (situated at about 9 kms. South of Madurai city, 2) Puliangulam area (situated within about 3 kms. from the Madurai University campus), and 3). Melakkal lake (a large irrigation lake situated at about 13 kilometres from the Madurai University campus). In the Thirupparankuntram area, excepting a temple tank, all other habitats studied were shallow, temporary, rainfed ponds. Likewise, in the Puliangulam area, one of the ponds studied was a permanent pond and another a temporary sewage water pond, the remaining ones being temporary, shallow, rainfed ponds.

Material and Methods:

Collections were made using a plankton net and brought to the laboratory in polyethylene containers, alive and in preserved conditions. Lugol's Iodine/Formalin were the preservatives used. As far as possible, the samples were studied soon after they were brought to the laboratory, in the living-state. Stained preperations were also made

to supplement the observations made on the live materials. Since this paper deals only with the Class Cyanophyceae and the Order Chlorococcales of the Class Chlorophyceae, monographs by Desikachary (1959) and Philipose (1967) were very useful in the identification of the algae.

The following are the species recorded from the three areas of Madurai under study :-

Class : *Cyanophyceae*

Order : *Chroococcales*

Family: *Chroococcaceae*

Genus : **Microcystis** *Kutzing*

Microcystis robusta *(Clark) Nygaard*
(Desikachary, 1959. p. 91. pl. 17/figs. 7-10)
This species was recorded from a permanent pond from Puliangulam area.

Microcystis protocystis *Crow*
(Desikachary, 1959. p.91. pl.20/figs 4)
This species was recorded from a temporary pond in Thirupparankuntram.

Microcystis aeruginosa *Kutz.*
(Desikachary, 1959. p. 93. pl. 17/figs. 1, 2, 6 & pl.18/fig. 10)

This alga has been recorded from Melakkal lake, 2 temporary ponds from puliangulam area and 3 temporary ponds from Thirupparankuntram. In 3 temporary ponds it formed blooms.

Microcystis flos-aquae *(Wittr.) Kirchner*
(Desikachary, 1959. p.94. pl.17/fig. 11 & pl. 18/fig.11)
This alga has been recorded from the temple tank in Thirupparankuntram and from two temporary ponds in Puliangulam area.

Microcystis pulverea *(Wood) Forti*
(Desikachary, 1959. p. 96)
This alga has been recorded from Melakkal lake alone.

Microcystis elabens *(Breb.) Kutz.*
(Desikachary, 1959. p. 97. pl.18/fig.12 & pl.20/figs. 6.7,) This alga has been recorded from Melakkal lake and two temporary ponds from Puliangulam area.

Genus : **Chroococcus** *Nag.*

Chroococcus minutus *(Kutz.) Nag*
(Desikachary, 1959. p. 103-105. pl.24/ fig. 4 & pl. 26. figs. 4, 15)
This species has been recorded from the permanent pond from Puliangulam area and Melakkal lake.

Chroococcus minor *(Kutz.) Nag.*
(Desikachary, 1959. p. 105. pl. 24/fig.1)
This species has been recorded from one permanent pond and one temporary pond from Puliangulam area and from Melakkal lake.

Chroococcus hansgirgi *Schmidle*
(Desikachary, 1959. p. 105)
Recorded from one temporary pond from Puliangulam area.

Genus : **Gloeocapsa** *Kutzing*

Gloeocapsa decorticans *(A. Br.) Richter*
(Desikachary, 1959 p. 114 pl.24/fig. 9)
Recorded from Melakkal lake and from one temporary pond from Puliangulam area.

Genus : **Gloeothece** *Nag.*

Gloeothece samoensis *Wille*
(Desikachary, 1959. p.128. pl.23 / fig.3)
Recorded from one temporary pond from Puliangulam area.

Genus : **Aphanocapsa** *Nag.*

Aphanocapsa pulchra *(Kutz.) Rabenh.*
(Desihachary, 1959, p 132. pl. 21/fig. 2)
This species has been recorded from Melakkal lake and from one temporary pond from Puliangulam area.

Genus : **Aphanothece** *Nag.*

Aphanothece conferta *Richter*
(Desikachary, 1959. p. 140)
Recorded from Melakkal lake alone.

Aphanothece castagnei *(Breb.) Rabenh.*
(Desikachary, 1959 p. 140. pl. 21 / fig. 8)
This species also has been recorded from Melakkal lake alone.

Aphanothece pallida *(Kutz.) Rabenh.*
(Desikachary, 1959. p. 140-141. pl. 22/fig. 3)
This species has been recorded from a temporary pond from Thirupparankuntram area.

Genus : **Synechococcus** *Nag.*

Synechococcus aeruginosus *Nag.*
(Desikachary, 1959. p. 143. pl. 25/figs. 6, 12)
This species has been recorded from two temporary ponds from Puliangulam area and one temporary pond from Thirupparankuntram.

Genus : **Synechocystis** *Sauvageau*

Synechocystis aquatilis *Sauv.*
(Desikachary, 1959. p. 144. pl. 25/fig. 9)
This species has been recorded from one permanent pond and one temporary pond from Puliangulam.

Genus : **Coelosphaerium** *Nag.*

Coelosphaerium naegelianum *unger.*
(Desikachary, 1959. p. 147 pl. 28/figs. 9,16)
This alga has been recorded from two temporary ponds from Puliangulam area.

Genus : **Merismopedia** *Meyen*

Merismopedia punctata *Meyen*
(Desikachary, 1959. p. 155. pl. 23/fig. 5 & pl. 29/ fig. 6)
This alga has been recorded from the temple tank of Thirupparankuntram, 4 temporary ponds from Puliangulam area and Melakkal lake.

Order : **Nostocales** *Geitler*

Family : **Oscillatoriaceae** *Kirchner*

Genus : **Arthrospira** *Stizenberger*

Arthrospira platensis *(Nordst) Gomont. f.* **granulata** *Desikachary (Desikachary, 1959. p. 190. pl. 35/figs. 5, 6)*
This species has been recorded from one temporary pond from Thirupparankuntram area.

Genus : **Spirulina** *Turpin em. Gardner*

Spirulina laxissima *G. S. West*
(Desikachary, 1959. p. 196. pl. 36/fig. 5)
Recorded from one temporary pond from Puliangulam area.

Spirulina major *Kutz. ex. Gomont*
(Desikachary, 1959. p. 196-197. pl. 36/fig. 13)
This species has been recorded from Melakkal lake and one temporary pond from Puliangulam area.

Spirulina gigantea *Schmidle*
(Desikachary, 1959. p. 197-198. pl. 36/figs. 12, 14-17)
Recorded from one temporary pond from Puliangulam area alone.

Genus : **Oscillatoria** *Vaucher*

Oscillatoria annae *Van Goor*
(Desikachary, 1959. p. 203. pl. 38/fig. 13)
This alga has been recorded from Melakkal lake alone.

Oscillatoria subbrevis *Schmidle*
(Desikachary, 1959. p. 207. pl. 37/fig. 2 & pl. 40/fig.1)
This alga has been recorded from one temporary pond from Thirupparankuntram area.

Oscillatoria subbrevis *Schmidle f.* **crassa** *Dixit*
(Desikachary, 1959. p. 209)
This alga has been recorded from Melakkal lake alone.

Oscillatoria chalybea (*Mertens*) *Gomont*
(Desikachary, 1959. p. 218-219. pl. 38/fig. 3)
This alga has been recorded from one temporary pond from Puliangulam area.

Oscillatoria jasorvensis *Vouk.*
(Desikachary, 1959. p. 221-222)
This species has been recorded from one temporary pond from Puliangulam area.

Oscillatoria okeni *Ag. ex Gomont*
(Desikachary, 1959. p. 231. pl. 38/fig. 17)
This species has been recorded from one temporary pond from Thirupparankuntram area.

Genus : **Lyngbya** *Ag.*

Lyngbya hieronymusii *Lemm.*
(Desikachary, 1959. p. 297. pl. 48/fig. 4)
Recorded from Melakkal lake alone.

Lyngbya cryptovaginata *Schkorbatow*
(Desikachary, 1959. p. 297-298. pl. 50/fig. 6)
This species also has been recorded from Melakkal lake a'one.

Genus : **Microcoleus** *Desmazieres*

Microcoleus lacustris *(Rabenh). Farlow*
(Desikachary, 1959. p. 345. pl. 60/figs. 4, 5)
Recorded from one temporary pond from Thirupparankuntram area.

Family : NOSTOCACEAE Kutzing

Sub-family : ANABAENAE

Genus : **Pseudoanabaena** *Lauterborn*

Pseudoanabaena catenata *Lauterb*
(Desikachary, 1959. p. 419)
Recorded from Melakkal lake alone

Genus : **Aulosira** *Kirchner*

Aulosira prolifica *Bharadwaja*
(Desikachary, 1959. p. 426-428. pl. 81/figs. 1-6).
This alga also is recorded from Melakkal lake alone.

Aulosira fertilissima *Ghose*
(Desikachary, 1959. p. 431. pl 80/fig. 6)
This species has been recorded from Melakkal lake alone.

Class : CHLOROPHYCEAE

Order : CHLOROCOCCALES March and Orth. mut. et emend Pascher

Family : CHARACIACEAE (Naegeli) Wille

Genus : **Characium** *A. Braun ex Kuetzing*

Characium ambiguum *Hermann ex Rabenhorst*
(Philipose, 1967. p.82-83. fig.7)
This alga has been recorded from one temporary pond from Puliangulam area.

Characium debaryanum *(Reinsch) De Toni*
(Philipose, 1967. p.85. fig. 12)
This alga has been recorded from one temporary pond from Thirupparankuntram area.

Genus : **Korshikoviella** *Silva.*

Korshikoviella limnetica *(Lemm.) Silva*
This species has been recorded from one permanent pond and one temporary pond, both from Puliangulam area.

Genus : **Schroederia** *Lemmermann emend Korshikov.*

Schroederia setigera *(Schroeder) Lemmermann*
(Philipose, 1967. p.89-90. fig. 17)
This alga has been recorded from one temporary pond from Puliangulam and another temporary pond from Thirupparankuntram area.

Schroederia indica *Philipose*
(Philipose, 1967. p. 90. fig. 19)
This species has been recorded from one temporary pond from Puliangulam area alone.

Family : CHLOROCHYTRIACEAE (Naegeli) Wille

Genus : **Kentrosphaera** *Borzi*

Kentrosphaera bristolae *G.M Smith*
(Philipose, 1967. p 96-97. fig.21)
This alga has been recorded from Melakkal lake alone.

Family : MICRACTINIACEAE (Brunnth.) G.M. Smith

Genus : **Trochiscia** *Kuetzing*

Trochiscia reticularis *(Reinsch) Hansgirg*
(Philipose, 1967. p 100-101. fig. 25)
This species has been recorded from one temporary pond from Puliangulam area.

Family : HYDRODICTYACEAE (S.F. Gray) Dumortier orth. mut. Cohnemend

Sub-family; Hydrodictyoideae

Genus : **Pediastrum** *Meyen*

Pediastrum simplex *Meyen*
(*Philipose, 1967, p. 113-114 fig.36 a-c.*)
This alga has been recorded from one temporary pond from Puliangulam area.

Pediastrum simplex *Meyen var.* **duodenarium** (*Bailey*) *Rabenhorst*
(*Philipose, 1967. p. 115. fig. 36 d-h.*)
This variety has been recorded from one temporary pond from Puliangulam area.

Pediastrum boryanum (*Trupin*) *Meneghini*
(*Philipose, 1967. p, 118-119. fig. 40a.*)
This species was recorded from two temporary ponds from Puliangulam area.

Pediastrum duplex *Mayen var.* **genuinum** (*A. Braun*) *Hansgirg*
(*Philipose, 1967. p. 123. fig. 43d.*)
This variety has been recorded from Melakkal lake alone.

Pediastrum duplex *Meyen var.* **reticulatum** *Lagerheim.*
(Philipose, 1967. p. 124. fig. 43g.)
This variety has been recorded from the temple tank at Thirupparankuntram.

Pediastrum duplex *Meyen var.* **gracillimum** *W. et G. S. West* (*Philipose, 1967. p. 124-125. fig. 43 h, i.*)
This variety was recorded from Melakkal lake alone.

Pediastrum tetras (*Ehr.*) *Ralfs.*
(*Philipose, 1967. p. 128-129. fig. 45. a-c.*)
This alga has been recorded from Melakkal lake, temple tank at Thirupparankuntram and two temporary ponds from Puliangulam area.

Pediastrum tetras (*Ehr.*) *Ralfs var.* **tetraodon** (*Corda*) *Hansgirg*
(Philipose, 1967. p. 129. fig. 45-d, e & g)
This variety has been recorded from Melakkal lake and two temporary ponds from Puliangulam area.

Pediastrum tetras (*Ehr.) Ralfs var.* **excisum** (*Rabenh.*) *Hansgirg* (*Philipose, 1967. p. 129. fig. 45f.*)
This variety has been recorded from one temporary pond from Puliangulam area alone.

Genus : **Sorastrum** *Kuetzing*

Sorastrum spinulosum *Naegeli*
(*Philipose, 1967. p. 132-133. fig. 47*)
This alga has been recorded from Melakkal lake alone.

Sub-family : *Tetraedronoideae*

Genus : **Tetraedron** *Kuetzing*

Tetraedron trilobulatum (*Reinsch*) *Hansgirg*
(*Philipose, 1967 p. 137. fig.50*)
This species has been recorded from Melakkal lake only.

Tetraedron muticum (*A. Braun*) *Hansgirg*
(*Philipose, 1967. p. 137-138. fig. 51-a, b.*)
This species has been recorded from the temple tank of Thirvpparankuntram and 4 temporary ponds from Puliangulam area.

Tetraedron minimum (*A. Braun*) *Hansgirg*
(*Philipose, 1967. p. 138. fig. 53-a, b, c.*)
This alga was recorded from one temporary pond from Puliangulam area.

Tetraedron tumidulum (*Reinsch*) *Hansgirg*
(*Philipose, 1967. p. 139. fig-54*)
This species was recorded from the temple tank of Thirupparankuntram only.

Tetraedron trigonum (*Naegeli*) *Hansgirg f.* **minus** (*Reinsch*) *De Toni*
(*Philipose, 1967. p. 142. fig. 58c*)
This alga was recorded from Melakkal lake alone.

Tetraedron regulare *Kuetzing*
(*Philipose, 1967, p. 145. fig. 60, a, d, f.*)
One temporary pond from Puliangulam area alone had tkis alga.

Tetraedron regulare *Kuetzing var.* **granulata** *Prescott*
(*Philipose, 1967. p. 147-148. fig. 60 - i & 1*)
This variety was recorded fiom one temporary pond from Puliangulam area.

Tetraedron octaedricum (*Reinsch*) *Hansgirg var.* **spinosum** (*Reinsch*) *W. et G. S. West*
(*Philipose, 1967. p. 153. fig. 66*)
This variety was recorded from one temporary pond from Puliangulam area.

Tetraedron bifidum (*Turner*) *Wille*
(*Philipose, 1967. p. 154. fig-68*)
This alga was collected from Melakkal lake only.

Tetraedron gracile (*Reinsch*) *Hansgirg*
(*Philipose, 1967. p. 154. fig. 69, a, c*)
The temple tank of Thirupparankuntram had this alga.

Family : *OOCYSTACEAE Bohlin*

Sub-family : *Chlorelloideae*

Genus : **Chlorella** *Beijerinck*

Chlorella vulgaris *Beijerinck*
(*Philipose, 1967. p. 173. fig. 82*)

This alga was recorded from one permanent and three temporary ponds from Puliangnlam area.

Sub-family : *Oocystoideae*

Genus : **Gloetaenium** *Hansgirg*

Gloetaenium loitlesbergerianum *Hansgirg*
(*Philipose, 1967. p, 178-179. fig. 88*)
This alga was recorded from Melakkal lake alone.

Genus : **Oocystis** *Naegeli*

Oocystis solitaria *Wittrock*
(*Philipose, 1967. p. 180-181. fig. 89*)
This alga was recorded from Melakkal lake alone.

Oocystis crassa *Wittrock*
(*Philipose, 1967. p. 181. fig. 91*)
This species also was recorded from Melakkal lake alone·

Oocystis kumaonensis *K. P. Singh*
(*Philipose, 1967. p. 181-183. fig. 92*)
This alga was recorded from Melakkal lake only.

Oocystis borgei *Snow*
(*Philipose, 1967. p. 183. fig. 93*)
This species was recorded from one temporary pond from Puliangulam area and Melakkal lake.

Oocystis gigas *Archer*
(*Philipose, 1967. p. 183. fig. 94a*)
Recorded from Melakkal lake alone.

Oocystis irregularis (*Petkof*) *Printz*
(*Philipose, 1967 p. 184. fig. 95*)
This alga also was recorded from Melakkal lake alone.

Oocystis pusilla *Hansgirg var.* **major** *Skuja*
(*Philipose, 1967. p. 184-185. fig. 97*)
This species has been recorded from one temporary pond from Puliangulam area.

Oocystis naegeli *A Bravn*
(*Philipose, 1967. p. 185-186 fig. 98*)
This alga has been recorded from one temporary pond from Puliangulam area and from Melakkal lake.

Oocystis ecballocystiformis *Iyengar*
(*Philipose, 1967. p. 186. fig. 89*)
This alga has been recorded from Melakkal lake alone.

Family : **Botryococcaceae** *Wille*

Genus : **Botryococcus** *Kuetzing*

Botryococcus braunii *Kuetzing*
(*Philipose, 1967. p. 195-197. fig. 108*)
This species has been recorded from Melakkal lake alone.

Family · **Dictyosphaeriaceae** (*De Toni*) *G. S. West*

Genus : **Dictyosphaerium** *Naegeli*

Dictyosphaerium pulchellum *Wood*
(*Philipose, 1967. p. 199-200. fig. 110*)
This species was recorded from three temporary ponds from Puliangulam area and Melakkal lake.

Family : **Selenastraceae** (*Blachman et Tansley*) *Fritsch*

Genus : **Ankistrodesmus** *Corda*

Ankistrodesmus spiralis (*Turner*) *Lemmermann*
(*Philipose, 1967. p. 210-211. fig. 119 a-c*)
This species was recorded from Melakkal lake alone.

Ankistrodesmus spiralis (*Turner*) *Lemmermann var.* **fasciculatus** *G. M. Smith*
(*Philipose, 1967. p. 211. fig. 119 d*)
This variety also was recorded from Melakkal lake alone.

Ankistrodesmus falcatus (*Corda*) *Ralfs*
(*Philipose, 1967 p. 211-212. fig. 121 a, e*)
This alga was collected from the temple tank of Thirupparankuntram and Melakkal lake.

Ankistrodesmus falcatus (*Corda*) *Ralfs var.* **acicularis** (*A. Braun*) *G. S West*
(*Philipose, 1967. p. 213. fig. 121c*)
The temple tank and two temporary ponds of Thiruparankuntram and Melakkal lake had this variety.

Ankistrodesmus falcatus (*Corda*) *Ralfs var.* **radiatus** (*Chodat*) *Lemmermann*
(*Philipose, 1967. p. 213. fig. 121d*)
This variety was recorded frow Melakkal lake alone.

Ankistrodesmus convolutus *Corda*
(*Philipose, 1967. p. 213-214. fig. 122 a-d*)
This species was recorded from the temple tank of Thirupparankuntram, one permanent and four temporary ponds from Puliangulam area.

Genus : **Closteriopsis** *Lemmermann*

Closteriopsis longissima (*Lemm.*) *Lemmermann var.* **tropica** (*W. et G. S. West*) *W et G. S. West*
(*Philipose, 1967. p. 216-217. fig. 124*)

This alga was recorded from one temporary pond from Thirupparankuntram area and Melakkal lake.

Genus : **Selenastrum** *Reinsch*

Selenastrum minutum (*Naegeli*) *Collins*
(*Philipose, 1967. p 218-219. fig. 126*)
This alga was recorded from the temple tank of Thirupparankuntram.

Selenastrum westii *G. M. Smith*
(*Philipose, 1967. p. 221. fig 129*)
This species was recorded from one temporary pond from Puliangulam area.

Genus : **Kirchneriella** *Schmidle*

Kirchneriella lunaris (*Kirchner*) *Moebius*
(*Philipose, 1967. p. 222-224. fig. 131*)
This species was recorded from Melakkal lake alone.

Kirchneriella obesa (*W. West*) *Schmidle*
(*Philipose, 1967. p. 224. fig. 132*)
This species has been recorded from the temple tank of Thiruparankuntram, one temporary pond from Puliangulam area and Melakkal lake.

Kirchneriella contorta (*Schmidle*) *Bohlin*
(*Philipose, 1967. p. 224. fig. 133*)
This species has been recorded from one temporary pond from Puliangulam area.

Family : **Coelastraceae** (*West*) *Wille*

Genus : **Coelastrum** *Naegeli*

Coelastrum microsporum *Naegeli*
(*Philipose, 1967. p. 228-229. fig. 135*)
This species has been recorded from Melakkal lake, two temporary ponds from Puliangulam area and the temple tank of Thirupparankuntram.

Coelastrum sphaericum *Naegeli*
(*Philipose, 1967. p. 229. fig. 136*)
This species was recorded from one temporary pond from Puliangulam area and Melakkal lake.

Coelastrum cambricum *Archer var.* **intermedium** (*Bohlin*) *G. S. West*
(*Philipose, 1967. p. 231. fig. 138 b*)
This alga has been collected from one temporary pond from Puliangulam area.

Family : **Scenedesmaceae** *Oltmanus*

Sub-family : Crucigenoideae

Genus : **Crucigenia** *Morren*

Crucigenia apiculata (*Lemm.*) *Schmidle*
(*Philipose, 1967. p. 238. fig. 146*)
This species was recorded from Melakkal lake alone.

Crucigenia crucifera (*Wolle*) *Collins*
(*Philipose, 1967. p. 240. fig. 149*)
This alga was recorded from the temple tank of Thirupparankuntram and two temporary ponds and one permanent pond from Puliangulam area.

Crucigenia triangularis (*Chodat*) *Schmidle*
(*Philipose, 1967. p. 240. fig. 150*)
This species was recorded from the temple tank of Thirupparankuntram only.

Crucigenia quadrata *Morren*
(*Philipose, 1967. p. 241. fig. 152.*)
This species was recorded from the temple tank of Thirupparankuntram alone.

Sub-family : Scenedesmoideae

Genus : **Scenedesmus** *Meyen*

Scenedesmus dimorphus (*Turpin*) *Kuetzing*
(*Philipose, 1967. p. 249-250. fig. 160 a-c*)
This species was collected from Melakkal lake, four temporary ponds from Puliangulam area, the temple tank of Thirupparankuntram and one temporary pond from Thirupparankuntram area.

Scenedesmus bernardii *G.M. Smith*
(*Philipose, 1967. p. 251-252. fig. 162*)
This species has been recorded from three temporary ponds from Puliangulam area and the temple tank of Thirupparankuntram.

Scenedesmus bijugatus (*Turpin*) *Kuetzing*
(*Philipose, 1967. p. 252-253. fig. 164 c, e, f*)
This alga was recorded from Melakkal lake and four temporary ponds from Puliangulam area.

Scenedesmus bijugatus (*Turpin*) *Kuetzing var.* **bicellularis** (*Chodat*) *M.T. Philipose*
(*Philipose, 1967. p. 253. fig. 164 d, n, o*)
This variety was recorded from the temple tank of Thirupparankuntram alone.

Scenedesmus bijugatus (*Turpin*) *Kuetzing var.* **alternans** (*Reinsch*) *Hansgirg f.* **parvus** (*G. M. Smith*) *M. T. Philipose*
(*Philipose, 1967. p. 256. fig. 164 h, j*)
This alga was recorded from Melakkal lake alone.

Scenedesmus platydiscus (*G.M. Smith*) *Chodat*
(*Philipose, 1967. p. 256. fig.165*)
This species has been recorded from one temporary pond from Puliangulam area.

Scenedesmus arcuatus (*Lemmermann*) *Lemmermann*
(*Philipose, 1967. p. 256-267. fig. 166*)
This species was recorded from Melakkal lake, two temporary ponds from Puliangulam area and the temple tank of Thirupparankuntram.

Scenedesmus prismaticus *Bruhl & Biswas*
(*Philipose, 1967. p. 259 fig. 168*)
This species was recorded from one temporary pond from Puliangulam area alone.

Scenedesmus acutiformis *Schroeder*
(*Philipose, 1967. p. 260. fig. 169*)
This species was recorded from Melakkal lake only.

Scenedesmus brasiliensis *Bohlin*
(*Philipose, 1967. p. 261. fig. 170*)
This species also has been recorded from Melakkal lake only.

Scenedesmus denticulatus *Lagerheim*
(*Philipose, 1967. p. 268-270. fig. 176 a-c*)
This alga has been recorded from Melakkal lake only.

Scenedesmus denticulatus *Lagerheim var.* **australis** *playfair* (*Philipose, 1967. p. 271. fig. 176. f-h*)
This variety also was recorded from Melakkal lake alone.

Scenedesmus quadricauda (*Turpin*) *Brebisson*
(*Philipose, 1967. p. 283-284. fig. 187a*)
This alga has been recorded from two temporary ponds from Puliangulam area.

Scenedesmus quadricauda (*Turpin*) *Brebisson var.* **bicaudatus** *Hansgirg*
(*Philipose, 1967. p. 284. fig. 187. k,l*)
This variety was recorded from the temple tank of Thirupparankuntram only.

Scenedesmus quadricauda (*Turpin*) *Brebisson var.* **longispina** (*Chodat*) *G.M. Smith*
(*Philipose, 1967. p. 285. fig. 187 b-c*)
This variety has been recorded from four temporary ponds from Puliangulam area.

Scenedesmus quadricauda (*Turpin*) *Brebisson var.* **quadrispina** (*Chodat*) *G.M. Smith*
(*Philipose, 1967. p. 285. fig. 187 a, j*)
This variety has been recorded from one temporary pond from Puliangulam area and Melakkal lake.

Scenedesmus quadricauda (*Turpin*) *Brebisson var.* **eualternans** *Proschk.*
(*Philipose, 1967. p. 285-286. fig 187e*)
This species was recorded from one temporary pond from Puliangulam area.

Scenedesmus quadricauda (*Turpin*) *Brebisson var.* **parvus** *G.M. Smith*
(*Philipose, 1967. p. 286. fig. 187f*)
This variety was recorded from the temple tank of Thirupparankuntram and one temporary Pond from puliangulam area.

Scenedesmus quadricauda (*Turpin*) *Brebisson var.* **maximum** *W. et G. S. West*
(*Philipose, 1967. p. 286. fig. 187 g*)
This variety was recorded from one temporary pond from Puliangulam area alone.

Scenedesmus quadricauda (*Turpin*) *Brebisson var.* **westii** *G.M. Smith*
(*Philipose, 1967. p. 286-287. fig. 187 h-i*)
This variety also was recorded from one temporary pond from Puliangulam area only.

Discussion

A total number of 115 taxa belonging to 37 genera and 96 species were recorded. Melakkal lake showed the maximum species diversity, with 58 taxa. This was followed by the permanent pond from Puliangulam area, with 26 taxa and the temple tank of Thirupparankuntram with 22 taxa. During the present study, 3 temporary ponds had blooms of *Microcystis aeruginosa* Kutz., with an unusually dense population of the alga which almost covered the entire surface area of the ponds. The ponds and lake mentioned here have a rich

variety of algal species belonging to other classes of alga also.

The present study also reveals that the species diversity is greater in permanent ponds.

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A SIMPLE TECHNIQUE FOR CONTINUOUS FEEDING OF *STREPTOCEPHALUS DICHOTOMUS* BAIRD (CRUSTACEA : ANOSTRACA)

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ABSTRACT

A technique for continuous feeding of filter feeders is described and it's efficiency in promoting the growth of a fresh water fairy shrimp Streptocephalus dichotomus *in discussed with experimental results.*

Introduction

The relationship between the concentration of food particles in the suspension of a medium and the feeding rate of filter feeders have been reported by Gauld 1951 and 1953), Marshall and Orr (1955), Rigler (1961), Reeve (1963), Mullin (1963), Mc Mahon and Rigler (1965), Richman (1966), Burns and Rigler (1967), Conover (1968), Kadar (1977), Santharam (1979) and many others. Under low concentractions of food in the medium the animal has to spend more energy to collect its required food, and in the high concentrations, the food, particles clog at the mandibular region and block further entry of food into the mouth (Esterly, 1916; Mc Mahon and Rigler, 1963 and Reeve, 1963) result in the elimination of faecal pellets in partially or undigested form (Reeve, 1963). One of the difficulties often faced under laboratory conditions is to keep the food particles in suspension for long periods of time.

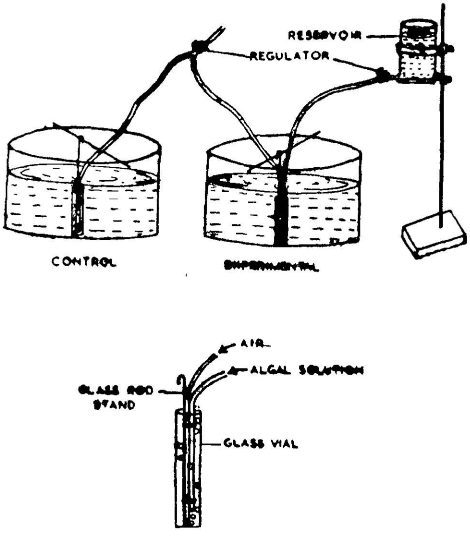
This paper deals with a simple technique for continuous feeding of filter feeders and also its efficiency in promoting the rate of growth of a fresh water fairy shrimp, *Streptocephalus dichotomus*.

Description of the apparatus

The apparatus consists of a small glass vial and two nylon tubes. A nylon tube with diameter 1.0 mm is connected with an aerator and a second tube diameter 2.0 mm is connected to a container which serves as a reservoir for the algal food. The nylon tubes are tied to a glass rod, which serves as a stand and prevents folding up of nylon tubes and also keeps the opening of the nylon tubes in a fixed position (Fig. 1). The glass

FIG I

TECHNIQUE USED FOR CONTINUOUS FEEDING



Growth of *Streptocephalus dichotomus* fed on *Chlorella* using the technique at 28 ± 1°C.

rod-stand with two nylon tubes is kept inside a glass vial. The diameter of the glass vial is 12.0 mm and the height of the vial is 10.0 mm less than the height of the water column in the glass trough or aquarium. The glass vial prevents the scattering of algal food as well as air bubble and directs them to the upper layers of the medium. Water is agitated only at the surface layer but remains undisturbed below. The regulators connected with the nylon tubes are used to control the flow of air-bubbles and algal solution.

Material and Methods

Small *Streptocephalus* ranging from 0.76 to 0.80 cm in size, collected from a nearby astatic pond were used for the present study. The animals were first acclamatized under laboratory conditions for two days in tap water. A minimum number of three animals of varying size groups was dried in hot air oven at 60°C for 48 hrs. and their average dry weight was taken as the initial dry weight of the particular size group of animal used in the experiment.

Twenty healthy animals, (10 males and 10 females), were introduced into two glass troughs with 4000 ml of tap water. The glass vial unit was kept inside the second trough and a nylon tube connected with the aerator was kept inside a glass vial in the first trough, which served as control.

The *Chlorella* culture with algal cells in log phase of growth was centrifuged, and the pellets were suspended in tapwater. This was recentrifuged and the cells in the pellet were resuspended in a small amount of tapwater. Equal amount of three samples of this algal solution was taken; two samples in two separate containers and the third sample in a watch glass. The solution in the containers were made upto 50ml with tapwater. The algal solution in the watch glass was dried in a hot air oven at 60°C for 48 hrs and from this the dry weight of the alga used as food was determined. The algal solution in one of the containers was poured slowly but uniformly into the first trough (control) without disturbing the animals and settled matter such as faecal pellets, exuviae of the animals, and debris. The algal solution in the second container was taken in the reservoir. The regulator in the reservoir was adjusted in such a way as to release the algal solution drop by drop inside the vial kept in the second trough (experimental). By this time, the aerator was also switched on. The outcoming air bubbles carry the algal solution to surface of the medium and spreading it at the surface layer. The whole algal solution in the reservoir took 30 minutes to reach the medium. In this way the food was supplied on a particular time of every day. The medium was changed once in three days and when the time the length of the animals was also measured. Since the mortality rate was higher in the first trough, the experiment was done only for 15 days and on 16th day, after measuring the length of the animals, the animals were dried in a hot air oven at 60°C for 48 hrs. and the dry weight of the animals reared in the two troughs were taken. The experiments were conducted at room temperature (28±1°C).

Results

The animals reared in the experimental trough showed faster rate of growth (Fig. 2, Table 1.) and increased dry weight (Table 2). The mortality rate was higher in the control. (Table. 3).

FIG. 2.

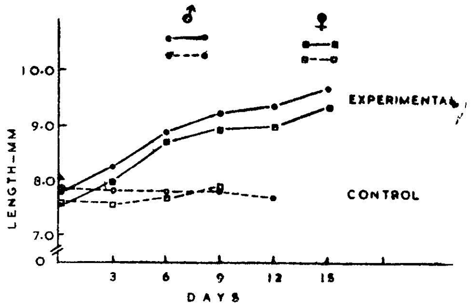


Table I : Growth of *Streptocephalus dichotomus* fed on *Chlorella* using the technique at 28 ± 1°C.

	Length (mm) of the animal after												
	0 day		3 days		6 days		9 days		12 days		15 days		Mean increased length
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	(mm/animal/day)
CONTROL													
Males	7.77	0.496	7.80	0.668	7.82	0.934	7.82	0.452	7.70	0.485	—	—	--
Females	7.52	0.390	7.54	0.587	7.71	0.456	7.91	0.581	—	—	—	—	—
EXPERIMENTAL													
Males	7.75	0.432	8.26	0.521	8.91	0.550	9.25	0.747	9.38	0.881	9.54	0.893	0.119
Females	7.54	0.463	7.96	0.440	8.74	0.515	8 96	0.707	9.00	0.752	9.37	0.643	0.122

Table II : Initial and final dry wt. of *dichotomus* fed on *Chlorella* using the technique at 28 ± 1°C.

	Initial dry wt. (mg/animal)	Final dry wt. (mg/animal)	Mean increased dry wt. mg/animal/day
CONTROL			
Males	0.184±0.04	0.120	—
Females	0.250±0.02	0.105±0.03	—
EXPERIMENTAL			
Males	0.184±0.04	0.390±0.14	0.0137
Females	0.250±0.02	0.374±0.09	0.0082

Table III : Percentage of mortality of *dichotomus* fed on *Chlorella* using the technique at 28±1°C

	Percentage of mortality observed on				% of Total Mortality
	6th day	9th day	12th day	15th day	
CONTROL					
Males	—	10.00	10.00	60.00	80.00
Females	—	40.00	30.00	20.00	90.00
EXPERIMENTAL					
Males	—	--	—	—	—
Females	—	10 00	—	10.00	20.00

Discussion

In the first trough (Control), the dense algal food in the medium accumulated at the mandibular region of the animal and blocked further ingestion of food into the mouth. Such clogging nature of food materials have been observed in *Calanus* by Esterly (1916), in *Daphnia magna* by Mc Mahon and Rigler (1963) and in *Artemia salina* by Reeve (1963) in high concentrated food in the medium. In *Streptocephalus dichotomous*, the thoracic limbs play an important role in producing the feeding currents and in filtering the food particles (Bernice, 1971). Hence the limbs are also the organs of locomotion and respiration, they are always found in constant motion. The vortex of water current produced by the limbs (Bernice, 1970 and 1971), resulted in continous accumulation of some amount of food in the mid groove region. Since the limbs and the midventral groove are facing upward, the dense algal food which was in downward movement accumulated easily in a short span of time. The improper ingestion rate leads to slower growth (Fig. 2, Table 1) and also increased mortality (Table 3) of animals reared in the first trough. Most of the dead animals were also found with dense clogging of algal food at the mandibular region. In the second trough (experimental), a normal flow of algal food was observed for about 30 min. The initial level of low concentration of algal food in the medium was compensated by the continuous supply of food and also the accumulation of high concentrations of food materials in the medium was prevented by rate of ingestion normally observed in the animals. The continuous supply of low concentrations of food facilitated maximum ingestion of algal food and the animals reared in the second trough grew well (Fig 2,Table 1) when compared with the animals reared in the

first trough. But in general, the growth rate per day (Table 1) and dry weight (Table 2) of the animals was slower when compared with field animals *S. dichotomus* is a contiuous filter feeder but in the experiment, the animals were provided with food only for about 42 min./day and that too with only one type of food.

The high percentage of mortality observed in the control may be mainly due to improper ingestion rates. Most of the animals showed slackened activities from the 4th day onwards and this resulted in a high Percentage of morality on the 9th, 12th and 15th day. The animals had no more stored energy to lead their life for some more days. One can understand this situation from Table 2. where the animals in the control showed reduced dry weight when compared with their initial dry weight.

Eventhough the amount of algal food introduced into the two troughs was equal in quantity (Table 4), two different methods were employed

Table IV : Dry weight of *Chlorella* sp. cells used as food. Each value represents the average amount of food used for three days (Mean ± S. D.)

S No	Days	Dry wt. of Chlorella sp (mg)
1	1—3	9.23±0.50
2	4—6	9.15±0.13
3	7—9	8.15±0.54
4	10—12	8.18±0.18
5	13—15	8 15±0.16

to supply the food. The continuous supply of low concentration of alga resulted in maximum rate of feeding of animals reared in the second trough. By using the regulator one can adjust the flow of food materials into the medium. This technique can also be used to rear continuous filer feeders like the brine shrimp *Artemia salina* (Reeve, 1963), the freshwater copepods *Spicodiaptomus chelospinus* Kadar *et al.*, 1976, and Kadar, 1977), *Rhinediaptomus indicus* (Singh, 1972) and the freshwater fairy shrimps *Streptocephalus dichotomus* and *Branchinella kugenumaensis* and the discontinuous filter feeders (Gauld, 1951). The continuous filter feeders show diurnal variations in their rate of feeding. *Spicodiaptomus chelospinus* feeds more during day hours (Kadar *et al.*,) 1976 whereas *Rhinediaptomus indicus* feeds more during night hours (Singh, 1972). Fuller, (1937), Wimpenney (1938) and Marshall and Orr (1955) have also shown that *Calanus* feeds more at night than during day hours. Moreover, the rate of feeding differs not only between filter feeders but also different stages of the same filter feeder. Normally, younger animals require more food due to high metabolic activity than older ones. Reeve (1963) found that an aged *Artemia salina* can satisfy its requirements in low concentrations of food in the media. By adjusting the regulator the food can be supplied according to the feeding rate as well as the feeding behaviour of the animals. The surface agitation taking place at the time of the food supply help to dissolve atmospheric oxygen into the medium and thus the oxygen requirement at the time of feeding (Kersting and Leegwater, 1976) is met. This device is useful to save wastage of food materials and also to culture large size individuals in a short span of time.

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STUDIES ON THE ZOOPLANKTON MIGRATION IN A EUTROPHIC RESERVOIR

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ABSTRACT

Zooplankton migration studies were carried out in Sathiar reservoir for a period of one year both at the surface and bottom. The diel migration of zooplankton which is typical to what happens elsewhere does not follow the diel cycle strictly and appears to be modified by factors such as anoxic conditions near the bottom which stopped their descent from the surface during certain months even at 12 noon.

Introduction

A feature of great interest is the way zooplankters with their limited powers of locomotion perform regular migration. In some cases the depth involved is also considerable about 30 fathoms (Odum, 1971). In the literature there are several works with reference to temperate waters such as Harris (1953), Baylor and Smith (1957), Banse (1964) and Hutchinson (1967). However, similar work with reference to tropical waters are meagre. In the Indian region, work on these lines was done by George (1961) in Naini Lake, Michael (1964) Krishnamoorthy and Visweswara (1967) in Gandhisagar Lake, Chacko and Krishnamoorthy (1954) in Madras fish pond and Sumitra (1969) in Madurai ponds.

In Sathiar investigation of zooplankton migration was carried out along with physico-chemical factors and their incidence at the surface and at the bottom of the reservoir was followed.

Material and Methods

Zooplankton samples from surface and bottom were collected diurnally starting from 6 a.m. to 6 p.m. of the next day at three hour intervals. A one phase 0.25 HP motor is connected through a long polythene tube to radially arranged series of polythene funnels five in number held in position on 0.5 meter radius metal ring. This device was lowered to any desired depth and the zooplankton pumped out to a collecting vessel and filtered through a plankton net of mesh size 0.2 mm. This was in fact an improvement upon similar device used by Sumitra (1969). The filtered samples were counted in a replica of Sedgewick-Rafter counting cell and the total count were expressed in terms of organisms per liter.

Results

The fluctuations in number of zooplankton at different hours are dealt in Table 1. It is evident that the zooplankton at the surface showed an increase during night hours and decrease in day time in most of the observations except in May, August and September 1977 and at these particular months, the zooplankton increased in day time when compared to night hours. In the diurnal migration, the maximum number of zooplankton at the surface occurred generally at 12 mid-night or at 3 a.m. and occasionally at 6 p.m. also. The minimum number of zooplankton occurred generally at 12 noon and 3 p.m. and occasionally at 9 a.m.

The bottom samples showed opposite trends to that of the surface. The zooplankton at the bottom decreased in night hours and increased during day time. The minimum occurred at 3 p.m. and also at 6 p.m. and maximum at 3 a.m. and also at 6 a.m. and rarely at 12 mid-night. But in the months of September 1977 to February 1978 the population at the bottom dwindled to nothing.

Discussion

Although in the present study no attempt has been made to study the diurnal variation of different

Table I : Vertical diel migration of zooplankton in Sathiar (24-hour study)
(S = Surface, B = Bottom)

		6 p.m.	9 p.m.	12 m.n.	3 a.m.	6 a.m.	9 a.m.	12 noon	3 p.m.	6 p.m.
1977 :										
May	S	176	186	167	179	148	101	174	160	102
	B	102	73	14	31	25	22	91	114	60
June	S	39	51	81	86	30	20	35	140	18
	B	60	62	31	57	110	60	68	78	38
July	S	110	66	95	89	52	76	33	11	89
	B	127	56	57	58	32	47	118	73	116
August	S	97	80	95	131	117	170	142	161	169
	B	170	141	193	102	131	141	129	165	100
September	S	146	181	152	130	85	61	147	110	152
	B	6	1	12	7	5	6	17	2	2
October	S	99	55	73	79	88	82	86	74	116
	B	0	0	0	0	0	0	0	0	0
November	S	152	116	140	208	136	62	62	62	164
	B	0	0	0	0	0	0	0	0	0
December	S	158	302	304	222	212	192	184	184	300
	B	0	0	0	0	0	0	0	0	0
1978 :										
January	S	146	242	252	124	114	80	114	120	220
	B	0	0	0	0	0	0	0	0	0
February	S	102	114	120	150	212	70	86	64	72
	B	0	0	0	0	0	0	0	0	0
March	S	178	170	122	162	186	134	124	114	116
	B	76	128	106	160	186	132	176	160	112

species of zooplankton, nevertheless the total zooplankton study revealed a general diurnal pattern of day time decrease and nocturnal increase at the surface. The relative abundance of zooplankton at night time and the decreasing trend during day time exhibiting the overall effect of light causing quantitative variation in plankton organisms at different hours of the day follows the "light effect" as reported by Sumitra (1969) in Madurai ponds and also by Krishnamoorthy and Visweswara (1965). Verma (1967) found that while *Diaptomus* (copepod) increased at the surface during night time, rotifer mainly *Brachionus* revealed great abundance at the surface in day time than in the night time. However, in Sathiar this rule was not to be seen during certain months (May, August and September (1977). A day time maximum number of total zooplankton at the surface was observed at 12 noon in May and September 1977 and at 9 a.m. in August 1977.

Hart and Allanson (1976) attributed the dusk and dawn movements of *Pseudodiaptomus hessi* to the stimulus provided by changes in the light intensity and/or endogenous activity changes. They observed depressions in vertical distribution of *P. hessi* between 20.00 and 04.00 hours and denoted such a phenomenon as Cushing's mid-night sink and Hutchinson's nocturnal sink. Rudjakov (1970) suggested nocturnal sinking to a depression of endogenous locomotor activity. But in the present study the near absence of zooplankton at the bottom appeared to be due to the anoxic conditions that prevailed from September 1977 to February 1978. Kannan & Job 1979. Hence it is seen that while light acts as the major factor governing migration of zooplankton oxygen and perhaps similar environmental factors could also play an important role in limiting the freedom of zooplankton to migrate as in Sathiar. Endogenous factors often go hand in hand with

light as a factor according to the following authors (Hart and Allanson 1976 and Rudjakov 1970) but dissolved oxygen seems to act as a limiting factor in this particular body of water. Michael, (1964). McLaren (1963) suggested that in unstratified lakes, the vertical migration of zooplankton might occur as an energy conserving opportunity and by spending part of the day in cooler and deeper water to which they migrate. The metabolitic cost of migratory movements and maintenance of pelagic distribution has been shown to be slight, amounting to considerably less than 1% of the total metabolic rate (Vlyman, 1970) in copepod. On the other hand discussing the data of Russel and Yonge presented by Allee *et al* (1949), Job (1978) contends that considering the depth and time taken for the up and down migratory cycle to be completed the zooplankton expend considerable energy and cannot afford to starve, but actually feed although not on the phytoplankton, but upon the detritus that rains down continuously from the surface waters.

Although the rate of change of light intensity provides a meaningful stimulus, planktonic crustacea in general are considered unable to monitor absolute light intensity (Ringelberg, 1961 and McNaught and Hasler, 1964). In marine zooplankton although pressure sensitivity has been recorded there is no clear evidence for the existence of mechanism for pressure sense in zooplankton (Hart and Allanson 1976). Hart (1977) found that feeding activity was low by day and high at night. Such changes in feeding activity as observed from gut analysis were associated with their transition from benthic (during day time) to pelagic waters till dawn.

In Sathiar, against the usual effect of light on the migration of zooplankton, the near anoxic layer towards the bottom (September 1977 to February 1978) appears to restrict the diel vertical movement to zooplankton. This may be one of the reasons for the unusual day time (12 noon) abundance of zooplankton at the surface during certain months, when normally they should be confined to the bottom.

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PREPARATION OF ACTIVE CHLOROPLAST PARTICLES AND ENZYMES FROM ALGAE USING CELL MILL

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Key words : Chloroplast particles, Scenedesmus, Cell Mill

ABSTRACT

Fractionation of the algal cells using 'Cell Mill' was found to yield highly active chloroplast particles and crude enzyme source. The photosynthetic rates of the particles were found to be over four fold when compared with the method of breaking the cells by grinding in a mortar with pestle. The enzymatic reactions were found to be best preserved only when the 'Cell Mill' was used to break the algal cells.

Introduction

Though several methods for breaking the algal cells have been reported some of them are successful for only one species. Breaking of cells using French Press (French and Milner, 1955), or mechanical grinding in a mortar together with sand (Gorman and Levine, 1965) or a warring blender (Kahn, 1966) has been achieved for a few selected species. Hydrolysis of the cell wall enzymatically by trypsin treatment has also been reported (Boger, 1971). Algae like *Chlorella, Scenedesmus* are resistant to most of the above methods.

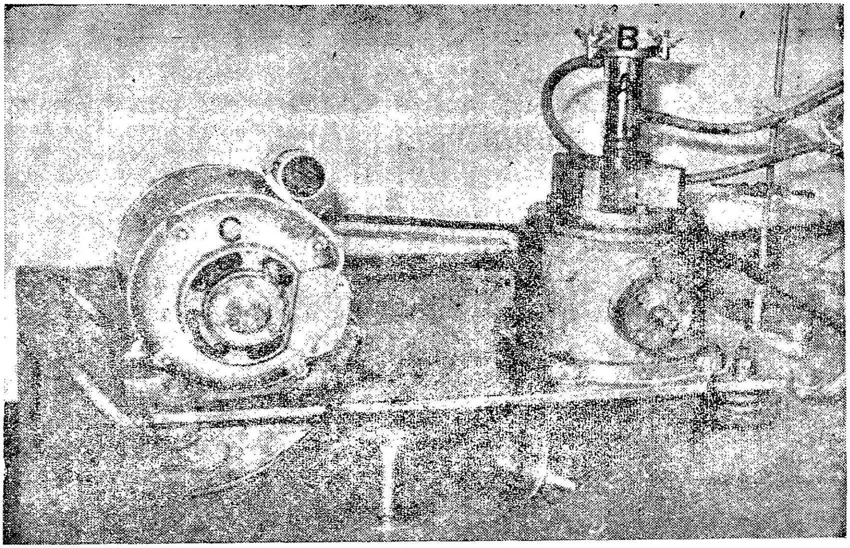
Successful application of the "Vibrogen Zellmühle" (Cell Mill) was reported for *Chlorella, Cyanidium* and *Anacystis* (Richter and Senger, 1964) and *Scenedesmus* (Pratt and Bishop, 1968; Berzborn and Bishop, 1973). A recent review (Senger and Mell, 1977) on the preparation of photosynthetically active particles from unicellular algae describes the advantages of using the Cell Mill for fast disruption with high yield and activity. This report gives a few additional facts on the advantages of using the Cell Mill for fractionation of the unicellular algae especially for enzymatic studies.

Materials and Methods

The Cell Mill (Fig. I) (manufactured by M/s Universal Biochemicals, Madurai) based on the original patent of the Firma E. Bühler, 7400 Tübingen, West Germany, *in principle has a stainless steel* chamber, shaking vertically with a frequency of 80Hz and an amplitude of 12mm. Cups of 7.5, 12.0, 23.0 ml in volume could be inserted in the chamber. The cups are packed to 90% volume with glass beads (0.55 mm ϕ) and cell suspension was added at a chlorophyll concentration of 200 ug/ml till the glass beads get moistened. The cup is then fitted in the vibrating chamber. Water at 1-2°C was circulated around the cup from a thermostatic bath. Shaking for a period of 2-3 min was found sufficient to break upto 90% of the cells. For other details see Senger and Mell (1977).

For mechanical grinding cells at 1.0 mg chl/ml were mixed with sand and ground in a porcelain mortar at 2°C in the cold room. While French Press (India Hydraulic Jack) was used cells were suspended at a concentration of 500 μg chl/ml. Pressure was given at 20,000 lb/in^2. In all the methods the supernatants obtained after centrifugation at 3,000 g for 5 min or 20,000 g for 30 min were used respectively as the source of chloroplast particles and enzymes.

Scenedesmus obliquus was grown heterotrophically as described by Kulandaivelu and Senger (1976). Cells were harvested 3 days after the inoculation. Photosynthetic reduction of DCPIP was mea-



The 'Cell Mell'
A - Vibrating Compartment B - Lid C - Motcr D - Stainless Steel Cup

sured spectrophotometrically at 610nm. NADP-Malate dehydrogenase (NADP-MDH, E.C.I. I. 1. 40) activity was measured as the reduction in absorbance at 340 nm (Mukerji and Ting, 1968). Chlorophyll concentration was estimated by the method of Mackinney (1941) and protein according to Lowry *et al.*, (1951).

Results and Discussion

Comparative rates of dischlorophenol indophenol (DCPIP) photoreduction by chloroplast fragments isolated by different techniques are given in Table 1. This measurement was selected since the reduction of the dye requires the photoelectron transport from the photosystem II and the enzymatic water oxidation which liberates 0_2. Water in such a system serves as the electron donor which could be replaced if artificial donors like diphenyl carbozide (DPC) is added. Isolation of chloroplast particles by grinding the cells in a mortar with pestle together with sand or using French Press was found to reduce the rate of the dye reduction by about 75 and 50% respectively, when water acts as the electron donor. The loss in activity of the overall electron transport could be either due to the inactivation of the enzymatic water oxidation step or the pigment complex of the photosystem II. To check this we have followed the dye reduction in the presence of an artificial electron donor, DPC, which cuts off the enzymatic water oxidation reaction. The DPC-mediated dye reduction was found to be only around 30% when chloroplasts were isolated by grinding or using French Press. This, clearly indicate though comparatively the enzymatic 0_2 evolving system is better preserved in chloroplasts isolated by French Press, the pigment complex of photosystem II, is similarly affected as that found in the chloroplasts isolated by mechanical grinding. In contrast, both systems were found to be well preserved when the Cell Mill was employed to break the cells.

Table I : Levels of DCPIP photoreduction with *Scenedesmus* chloroplast particles isolated by different techniques. Figures in parentheses are percentage with reference to the respective maximal activity

Isolation method	umoles DCPIP/mg chl/hour	
	Control	+ DPC (0.5 mM)
Cell Mill	187.72 (100.0)	697.24 (100.0)
French Press	91.96 (49.0)	205.14 (29.4)
Grinding	46.71 (24.9)	202.40 (29.0)

To confirm this further, we have studied the relative level of the NADP-MDH activity which is one of the key enzymes in heterotrophically growing algae. More or less similar trend as that of the dye reduction (which include enzymatic water oxidation) was observed in this case with around 18 and 41% activity when the enzyme extract was prepared respectively by grinding or using the French Press (Table 2)

Table II : Levels of NADP-MDH activity in preparation obtained by different methods. Figures in parentheses are percentage of maximum activity.

Method	umoles NADP reduced/mg protein/hr
Cell Mill	0.87 (100.0)
French Press	0.36 (41.4)
Grinding	0.16 (18.4)

Our present study shows that breaking of algal cells by grinding together with sand drastically lower both enzymatic and photochemical activities; usage of French Press though preserved partially the enzymatic activity, alters the photoelectron transport either by disturbing the pigment complex or inactivating the electron transport intermediate, plastoquinone and both the enzymatic and the pigment complexes are well preserved when the cells were broken in a Cell Mill.

Acknowledgements

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EFFECT OF LOW TEMPERATURE ON EGG VOLUME OF *DAPHNIA CARINATA* KING (CLADOCERA : DAPHNIDAE)

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ABSTRACT

The present study reveals the effect of low temperature on the egg volume of **D. carinata.** *Lower temperature results in increase in volume of the eggs. This results in decreased production of eggs.*

Introduction

It has been recognized that growth of *Daphnia* can be greatly affected by environmental factors. Egg production is also affected by the same environmental factors that affect the growth of *Daphnia.* Of the various factors the effect of temperature on egg production has been studied by various authors. (Tauson, 1930; Berg, 1931; Fox *et al.*, 1951: Venkataraman, 1977). In the genus *Daphnia* there is a definite relationship between body size and egg size : larger species have larger eggs (Green, 1956). The present investigation was undertaken to study the effect of temperature on egg volume, when the body size is constant.

Material and Methods

Daphnia Carinata king were collected and reared in the laboratory at room temperature (28-30°C) and at 15°C. They were fed with the algae *Scenedesumus.*

From the animals measuring 2±0.05 mm in length, eggs were dissected out. They were placed on a slide and covered with water. Two diameters of the eggs were measured; the greatest and the least. Only eggs with granular transparent edges with fat calls (Stage II) were taken for measurement since freshly laid eggs are not suitable for measurement. Applying the formula of Green (1956) that $V=\frac{1}{6}-\pi gl^2$ where 'g' is the largest diameter and 'l' is the least diameter of the egg, the volume of the eggs was found out.

Results and Discussion

The volume of eggs of individuals reared at 15°C was found to be more than the volume of the eggs of those reared at room temperature (28-30°C) (Table I).

Lack (1954) has pointed out that the larger number of smaller 'summer' eggs poor in yolk contrasts with the smaller number of large 'winter' eggs rich in yolk. Though he refers to the parthenogenetic and ephippial eggs, the principle may be applied here. The richness of yolk of eggs developed at low temperature may be the reason for the increase in volume. It has already been found that *D. carinata* at room temperature (29-31°C) produces to the maximum of 35 eggs/brood (Navaneetha krishnan & Michael, 1971) and at 15°C produces only 20 eggs/brood (Venkataraman, 1977). The lesser number of egg production at low temperature may be due to the increase in volume.

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Table I

Temp	No. of eggs measured	Mean largest diameter (g) (u)	Mean least diameter (l) (u)	Egg Volume (cu.u)
28 – 30°C	50	300	263	108×10^5
15°C	50	318	300	149×10^5

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MICROBIOLOGICAL PROPERTIES OF ANAEROBIC DIGESTIVE SYSTEMS

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The usefulness of microorganisms in bringing about biodigestion of organic wastes under anaerobic conditions has been established (Burbank *et al* 1956., Toerien, 1967., and Bryant, 1976). Such a system seems to promote the biogeneration of methane, the much needed burning gas, which at present is attracting the attention of many scientists in different countries. (Burbank *et al* 1956; Hobson *et al* 1974; and Jewell *et al* 1976). Apart from providing biogas, the utilisation of wastes not only helps to maintain a cleaner environment but also, at the end, results in good organic manure, rich in N,P,K content for application in the fields. This paper is an attempt to discuss briefly the valuable role played by microorganisms in the bioconversion of wastes through anaerobic digestive systems.

Methods and Materials

a. *Sampling* :

The composite slurry samples from the anaerobic fermentative digestors located in 4 different places (Courtallam, Coimbatore, Madurai and Gandigram) were collected in 250 ml capacity, sterile, wide-mouthed ground in stoppered glass containers for carrying out the microbiological examination. Care was exercised to avoid external contaminaation during sampling and transport.

In order to compare the relative distribution of microorganisms, the slurry specimens from the anaerobic biogas digestor designed by the Tamil Nadu Agricultural University at different depths viz. 40.60 and 90 c.m. were collected and screened.

b. *Microbiological examination :*

The different types of microorganisms in the various slurry specimens were estimated using various media favouring the growth of bacteria, fungi, actinomycetes, cellulolytic organisms, and methanogenic bacteria-following the serial dilution plate technique (Timonin, 1940 ; Rajasekaran and Lakshmanan 1978). The bacterial, fungal and actinomycetes colonies were enumerated on the 3rd, 7th and 10th day respectively; the coliforms and fecal streptococci on the 2nd day after incubation at 37° and 44°C respectively by employing the MPN multi-tube dilution technique as described in Standard Methods (Anon, 1965). The methanogens were enumerated by counting colonies from plates that favoured the growth of organisms after incubation in vacuum oven at 37°C, flushed with a gas mixture of 80% H_2 and 20% CO_2. (Zeikus, 1977). The populations were computed and expressed per gram of oven-dry samples

Results and Discussion

The microbial population enumerated from the slurry samples collected from various biogas generating digestors are presented in Table 1. The

Teble I : Maximum microbial population enumerated in slurry samples from various biogas plants (Population expressed pergon oven dry basis)

Organisms	Dilution	Courtallam	TNAU Coimbatore	Madurai	Gandhigram
Bacteria	10^6	*424.3	329.5	483.3	90.3
Fungi	10^4	6.6	3.2	21.7	4.0
Actinomycetes	10^4	38.6	1 7	1.3	9.3
Cellulolytic organisms	10^4	47.3	12.5	16.2	31.2
Coliforms	10^4	11.6	10.1	17.8	7.8
Faecal streptococci	10^2	9.3	11.8	8.5	4.5
Methanogenic bacteria	10^8	147.5	110.9	73.5	116.5

*The figures represent the mean of two samples

relative distribution of organisms at different depths in the slurry samples from the mobile biogas plant designed at the Tamil Nadu Agricultural Uuiversity is in Table 2.

Table II: Distribution of microorganisms at different depths in biogas plant (TANU-design) (Expressed in 10^4/g of oven dry sample)

Organisms	Depths from where samples were collected		
	40 cm	60 cm	90 cm
Bacteria	6750.0	5700.0	3950.0
Fungi	10.5	3.5	2.5
Actinomycetes	9.5	5.0	2.5
Cellulolytic organisms	16.5	6.0	4.5
Coliforms	9.8	6.2	3.4
Faecal streptococci	0.03	0.03	0.01
Methanogenic bacteria	5.23	6.23	7.64

The total bacterials population was found to be more in the slurry specimen obtain from Madurai (369.70×10^6/g) whereas the same in Gandhigram recorded the least. (101.30×10^6/g). The bacterial and other populations differed significantly from among the samples examined. Several factors such as temperature, pH and the type of raw material employed in biodigestion play a role in causing the differential distribution of various organisms enumerated. (Sathianathan, 1975 and Mohan Rao, 1974). However, methanogenic bacteria were found to occur in maximum numbers (125.1×10^3/g) in samples collected from Courtallam and least in Madurai (85.50×10^3/g.) The methanogens are directly connected with the liberation of biogas. Increasing the gas production might be possible by selective incorporation of efficient strains of methanogenic bacteria. The qualitative characterization of methanogens and establishing a correlation between the gas produced and the type of methanogenic bacteria may be able to throw some light on this issue.

The relative distribution of microorganisms at different depths from the mobile biogas digestor gave interesting results. Total bacteria, fungi, actinomycetes, coliform etc. found to decrease with increase in depth. Similar observations were recorded in soil. There is a declining trend in the different groups of organisms with the increase in depth. (Rose, 1954; and Oblisami, 1965). Same trend, might have been possible in an anaerobic digestive system. The methanogens increased from 5.23×10^4/g at 40 c.m. depth to 7.64×10^4/g at 90 c.m. depth. This is probably due to more anaerobiosis maintained at the lower strata of the anaerobic digestor. More elaborate studies are needed in this direction.

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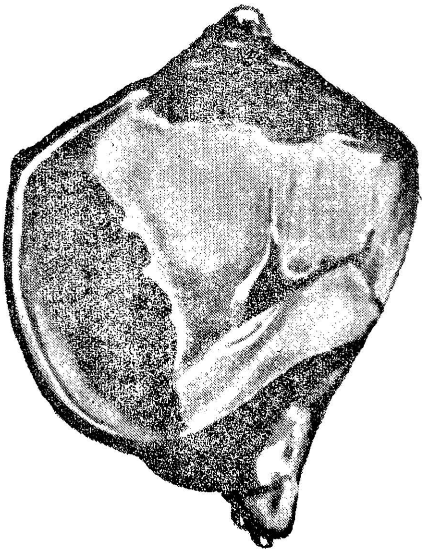
Short Communication

ON THE OCCURRENCE OF AN ABNORMAL CHANK *XANCUS PYRUM* (LINNE.) IN PALK BAY

There appear to be no records of abnormality in the shell of the sacred chank *Xancus pyrum* (Linne.) apart from the rare and famous sinistral *Valampuri* chanks with the aperture on the left side of the shell axis. A rare specimen of *Xancus pyrum* with abnormal shell (Figs. A and B) with the anterior or siphonal canal regenerated diagonally on the lower side of the columella was observed in trawl catch obtained with otter trawl by a private 32 ft. mechanised boat in Palk Bay in the vicinity of Athankarai at night on March 23, 1974. The abnormal chank was got from a depth of nine to ten metres where the sea bottom was muddy with some rocks lying here and there. Enquiries revealed that such abnormal chanks are got only occassionally. A brief description of the abnormal specimen is given below.

The chank is of the *obtusa* variety which is the common variety on the Coromandal coast and Palk Bay. The shell is topshaped and heavy and has a maximum diameter of 69.6 mm; the spire is short with whorls slightly concave; the apex is abraded and flat; the hole possess distinct angulated shoulders and there are slightly compressed tubercles on the shoulders; the columella is thickened with callus and has four transverse folds. Only a small proximal portion of the normal anterior canal is present. A regenerated anterior canal which extends diagonally from the base of the body whorl over the lower side of columella is present. The shell is covered by a thin, brown periostracum; the periostracum is eroded over a large part of the body whorl; the surface of the shell shows closely set spiral striations. The body whorl and the proximal portion of the normal anterior canal which is still present have been bored by boring sponges (Cliona sp.) and boring polychaetes (*Polydora sp.*). The edge of the outer lip is broken. The operculum is elliptical in shape and horny. The



soft parts of the chank which was caught alive were normal and did not show any signs of injury.

Shell regeneration has been reported in a number of prosobranchs of the temperate regions of the world by several workers (they are cited by Fretter and Graham, 1962 and Wilbur, 1964). Wagge and Mittler (1953) observed that there was no regeneration of shell in a number of prosobranchs, opisthobranchs, and bivalves when a hole was made away from the shell edge unless it was covered by some material. It has been shown that sources of calcium for shell regeneration in prosobranchs are the mantle, digestive gland, kidney, (Wilbur, 1964) blood and the medium.

The normal anterior canal of the present abnormal chank appears to have been broken as a result of an attack by a ray. In normal chanks the edge of the outer lip is very thin and sharp. But in the abnormal chank the edge of the outer lip is blunt and white and shows on microscopic examination three distinct layers viz. outer periostracum, middle prismatic layer and lower lamellate layer. This shows that the chank's shell was once again damaged most probably as a consequence of an attack by a ray. It is not possibly to say with certainity what is responsible for regeneration of the anterior canal in an unusual position. It may be due to chance or due to availability of a base over which the mantle edge could secrete shell. One other possibility is that the hindrance of boring sponges and polychaetes infesting the proximal portion of the normal anterior canal prevented regeneration of the canal in the usual position.

The author wishes to express his deep gratitude to Dr. K. S. Rao, Scientist, R. C. C. M. F. R. I., Mandapam Camp for his valuable help in preparing this note.

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A SIMPLE MONOCHROMATOR FOR ELIMINATION OF THE α_2 COMPONENT

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ABSTRACT

A simple method of using a suitable high angle reflection of the conventional plane monochromator for elimination of α_2 component without serious loss of α_1 intensity is discussed. Measurements with a silicon single crystal, optimising some of the operative factors governing the intensity, are presented and compared with other methods.

For precise topographic work and in certain other contexts, the α_2 component of the characteristic X-rays has to be removed, with minimum loss of the α_1 component intensity. Fine slit systems, about 100 microns and large distances, about 1 metre, had been employed in topographic work (Lang, 1966) for such purpose. In another method, a monolithic block of a single crystal, with specially cut grooves (Bonse and Hart, 1965) had been employed in their X-ray interferometric studies and this principle was also utilised for good angular resolution in T D S measurement (Krishan Lal *et al*, 1979).

Calvert, Killean and Mathieson (1974) reported α_1 peak intensity of 17000 counts per second using a pyrolytic graphite monochromator, 0 0 0 6 reflection, for Cu radiation. The estimated slit width required in their procedure α_1 separation is given in Table 1.

Denne (1977) has shown the possibility of obtaining monochromatic profiles using the specimen crystal itself as a dispersive element and by an ω/θ integration scan with restricted detector slits. Although the relative intensity ratio of the K_α doublet is reported, the actual intensity values for the monochromatic K_{α_1} is not furnished. This technique requires a suitable variable slit system for effective monochromatisation.

In the present paper, use of a high angle reflection for precise monochromatisation is pointed out and compared with other methods, although the idea of using high angle reflections is well known (Barth, 1960). We indicate that even the conventional plane monochromator can be used for elimination of α_2 without serious loss of α_1 intensity, if some of the operative factors, governing the intensity are optimised. A comparison with similar approaches is indicated in Table 1.

While several choices of crystal and reflection are possible, the principle is here discussed considering a silicon plane crystal monochromator, for the Cu K_α components and the 4 4 4 reflection. Table 2 lists the factors governing the integrated intensity (symmetrical Bragg reflection from a

Table 1 : Comparison of monochromated Cu K_{α_1} intensities.

Monochromator crystal and reflection	Bragg angles For Cu target $\theta(\alpha_1)$	$\theta(\alpha_2)$	Approximate slit width for α_1 Separation *	Peak intensity of α_1 component (counts/second)	Reference
Pyrolytic Graphite, 0 0 0 6	43.37°	43.51°	0.235 mm.	17,000	Calvert, Killen and Mathieson (1974)
Diamond, 4 0 0	59.75°	59.99°	Variable slit	not given	Denne (1977)
Silicon, 4 4 4	79.31°	80.09°	1.37 mm.	2500	Present work

* at 10 cm. from Crystal

Table 2 : Factors for the integrated intensity (Symmertical Bragg reflection from a mosaic crystal slab) for Si crystal, Cu K_α radiation.

Reflection	Mean Bragg angle	Parameters for the α_1 and α_2 components: Angular separation	Linear separation (at distance) of 10 cm	$\lvert F \rvert^2$	* Temperature factor $\exp(-2B \frac{\sin^2\theta}{\lambda^2})$	L. P. factors	Integrated intensity in micro-radians
1 1 1	14°–14′	0°-2′	0.06 mm.	3643	0.98	α_1 3.72 α_2 3.72	α_1 259 α_2 261
4 4 4	79°–42′	0°-47′	1.36 mm.	1595	0.72	α_1 5.12 α_2 5.57	α_1 114 α_2 125

* Debye-Waller factor (B) for Si is taken as 0.4 Å^2 (Sirota, N. N., 1969)

mosaic crystal slab), wherein the corresponding factors for the strongest reflection, 1 1 1, are also given.

From the Table 2, it is seen that although the $\lvert F \rvert^2$ and the temperature factors contribute to a reduction of integrated intensity by the factor $\frac{(1595)(0.72)}{(3643)(0.98)} = 0.32$, the L. P. factor appreciably offsets the same, by the factor $\frac{5.12}{3.72} = 1.38$. Thus the intensity of the α_1 component of 4 4 4 reflection is about 44% of the corresponding α_1 component of the strongest reflection 1 1 1 of Si. Furthermore even at a short distance of about 10 cm. from the crystal and with an ordinary slit width about 1mm., the α_2 can be effectively removed in the 4 4 4 reflection.

Choice of other crystals and high angle reflections is possible, (for example, the 4 0 0 reflection of tungsten with a ratio 0.55 for the α_1 of 4 0 0 to the α_1 intensity of 1 1 0, the strongest reflection). The Si crystal arrangement for the removal of α_2, as above, has been tried and found satisfactory, as discussed below.

Measurements with a silicon single crystal plane slab, surface nearly parallel to (1 1 1), are given in Table 3, using a set up (Chandrasekaran *et al.*, 1972)

Table 3 : Measurements of the integrated and peak intensities for Si crystal Cu K_α radiation in the present work

Reflection	Measured values in counts: Polished surface – Integrated intensity	Polished surface – Peak intensity for 1 second	Rough surface – Integrated intensity	Rough surface – Peak intensity for 1 second
1 1 1	4144	6743	4070	6342
* 4 4 4 α_1	1818	2790	1708	2204
* 4 4 4 α_2	1018	1472	806	1154

* Expected $\alpha_2 : \alpha_1$ ratio for the Cu $K\alpha$ radiation is about 0.5 (Int. Tables, 1962).

with minor improvisation for measurement upto upto $\theta = 80°$. The integrated intensities are in arbitrary units (total counts for the scanning range, corrected for background and absorption foil factors) and the peak intensities, for one second of time, are also furnished in Table 3. It is readily seen that measurements for both the polished and rough surfaces, with arbitrary perfection, still yield substantial peak intensities, with about 2500 counts per second for use as a monochromated Cu K_{α_1} beam and that the measured $\alpha_2 : \alpha_1$ ratio is approximately in agreement with the expected value of about 0.5 (Int. Tables, 1962).

Intensity comparions with the other types of monochromators for α_2 separation, mentioned in the first paragraph (Iang, 1966; Bonse and Hart, 1965), are difficult to estimate since the authors had not furnished the Cu K_{α_1} beam intensities. A primary beam intensity of the Cu K_{α_1} beam, with about 2500 counts per second, in the present method, is no doubt quite low; though it can be enhanced by a factor of about 2, by resorting to the Fankuchen cut (Fankuchen, 1937) for the Si crystal.

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ORTHOGONALITY IN BANACH SPACE AND APPROXIMATION THEORY

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Using James' Orthogonality, some conditions are derived under which a subspace is proximinal or Chebyshev. For a proximinal subspace M, 1(M) is the metric complement of M. In this paper, we have introduced the concept of pencils, and for a pencil C, 1(C) and r(C) have been defined. 1(C) and r(C) have been calculated for various subspaces C of some classical Branch Spaces. We have also obtained a characterization theorem for Hilbert Spaces it terms of the 1 and r operators.

Throughout this paper, R shall stand for the field of reals, X for a real Banach, space. X* for dual of X, $B(X) = \{x \in X : \|x\| \leq 1\}$, $S(X) = \{x \in X : \|x\| = 1\}$. For terminology and definitions not found in this paper, refer [1].

Definition :

(1) Let x, y∈X. x is said to be orthogonal to y, denoted by $x \perp y$, if $\|x\| \leq \|x + ky\|$ for all k∈R. That is, 0 is a best approximation to x from [y], the line through y.

(2) Let x ∈ X, H⊂X. x is said to be orthogonal to H, denoted by $x \perp H$, if, $x \perp y$ for each y∈H.

(3) Let A, B⊂X. A is said to be orthogonal to B, denoted by $A \perp B$, if $a \perp B$ for each a ∈ A.

Remark :

This notion of orthogonality coincides with the usual notion of orthogonality in a Hilbert Space.

Orthogonality in a Hilbert Space has also the following propeties.

1. Symmetry : If $x \perp y$, then $y \perp x$
2. Homogeneity : If $x \perp y$, then $ax \perp by$ for all a, b ∈ R.
3. Additivity : If $x \perp y$ and $x \perp z$, then $x \perp y+z$
4. Non-triviality : Given any two elements x and y, there exists a ∈ R such that $x \perp ax + y$.

In a general Banach space, orthogonality is clearly homogeneous. It is also non-trivial. The following two theorems substantiate this.

Theorem : 1.1.

Let f be a non-zero linear functional on X, and let x∈X. Then $|f(x)| = \|f\| \; \|x\|$ if, and only if $x \perp H$, where H is the hyperspace $f^{-1}(0)$.

Proof :

(i) Suppose $|f(x)| = \|f\| \; \|x\|$.

Let y ∈ H and k ∈ R.

Then $\|f\| \|x\| = |f(x)| = |f(x+ky)| \leq \|f\| \|x+ky\|$.

Hence $\|x\| \leq \|x+ky\|$, and this is true for all y ∈ H and k∈R.

Thus $x \perp H$.

(ii) Suppose $x \perp H$. Hence 0 is a best approximation to x from H. So, there is g ∈ X* such that y (H) = 0 and $g(x) = d(x, H) = \|x\|$, $\|g\| = 1$. Since f and g have the same kernel, $f = \lambda g$ for same λ ∈ R. $|f(x)| = |\lambda g(x)| = |\lambda| |g(x)| = |\lambda| \|x\| = \|f\| \|x\|$. ▭

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Theorem 1.2

Let $0 \neq x \in X$. Then there is a hyperspace H such that $x \perp H$.

Proof :

By Hahn-Banach Theorem, there is $f \in X^*$ ζζ₂. such that $f(x) = \|x\|$. By theorem 1. 1, $x \perp H$, where $H = f^{-1}(0)$.

□

Corollary :

Let $x, y \in x$, $x \neq 0 \neq y$. Then there is $a \in R$ such that $x \perp ax+y$.

Proof :

By Theorem 1.2, there is a hyperspace H such that $x \perp H$. Since $X = [x] + H$. Hence $y = -ax+h$ for some $a \in R$, $h \in H$. $h = ax + y$, and $x \perp h$, i.e $x \perp ax + y$.

□

Theorem 1.3

Let $x, y \in X$, $x \neq 0 \neq y$. Then there exists $b \in R$ such that $bx + y \perp x$.

Proof :

Let $-bx$ be a best approximation to y from [x]. Then o is a best approximation to $bx + y$ from [x]. That is $bx + y \perp x$.

□

Definition : (1)

A subset C of X is called a pencil if it is closed and, $x \in C$, $\alpha \in R \Rightarrow \alpha x \in C$.

(2) Let C be a pencil.

$1(C) = \{x \in X:$ o is a best approximation to x from C$\}$

$= \{x \in x: \ x \perp C.\}$

Remark :

(i) $1(C)$ is a pencil, and $C \cap 1(C) = \{o\}$.

(ii) If (C_1) and C_2 are pencils such that $C_1 \subset C_2$, then $1(C_1) \supset 1(C_2)$

(iii) If C_1 and C_2 are pencils, then $1C\ C_1 \cup C_2 = 1(C_1) \cap 1(C_2)$.

(iv) If $\{C_i\}\ i \in \Gamma$ is a family of pencils, and if $C = \bigcap_{i \in \Gamma} C_i$, then $1(C) = \bigcap_{i \in \Gamma} 1(C_i)$

Theorem 2.1.

Let M be closed subspace of X. Then :

(i) M is proximinal if, and only if, $X = M+1(M)$

(ii) M is chebyshev if, and only if, $X = M \oplus 1(M)$

The above theorem is easily verified.

Theorem 2. 2.

Let M be a proximinal subspace of X such that 1(M) is a subspace. Then M is chebyshev.

Proof :

Suppose $x \in x - m$ has two best approximations m_1 and m_2 from M. Then $x-m_1$ and $x-m_2 \in 1(M)$. Since 1(M) is a subspace, $(m_1-m_2) = (x-m_2) - (x-m_1) \in 1(M)$.

Hence $m_1 - m_2 \in 1(M) \cap M$, and thus $m_1 = m_2$.

□

Theorem 2.3.

Let M be a chebyshev subspace of X. Then 1(M) is nowhere dense.

Proof :

Suppose, if possible, $B(x_o, \delta) = \{x \in X: \ \|x - x_o\| < \delta\} \subset 1(M)$. Let $m_o \in M$ such that $\|m_o\| = 1$. Then x_o, $x_o + \frac{\delta}{2} m_o \in 1(M)$. Since 0 is a best approximation for $x_o + \frac{\delta}{2} m_o$, $-\frac{\delta}{2} m_o$ is a best approximation for x_o. But 0 is also a best approximation to x_o. This contradicts M being chebyshev.

Definition :

Let M be a closed subspace of X. Then, the map $P_M: X \to 2^M$ defined by $P_M(x) =$ the set of

best approximations to x from M, is called the *metric projection on M.*

Note : (1) $P_M(x) = \{m \in M: x-m \in l(M)\}$.

(2) If M is chebyshev, then P_M can be viewed as a map from X on to M.

Theorem 2.4.

Let M be a chebyshev, subspace of X. Then, l(M) is a subspace if and only if, P_M is linear.

Proof :

First, suppose l(M) is a subspace. Let x, y$\in$X. Then, $x-P_M(x)$ and $y-P_M(y)$ are in l(M). Since l(M) is a subspace, $x+y-\left[P_M(x)+P_M(y)\right]$ $\in l(M)$. That is, $P_M(x)+P_M(y)$ is the best approximation to x+y. In other words, $P_M(x+y) = P_M(x) + P_M(y)$. Homogeneity of P_M is proved similarly. Thus, P_M is linear.

Conversely, suppose P_M is linear. Let x, y $\in$ l(M). So, $P_M(x) = 0 = P_M(y)$. Hence, $P_M(x+y) = P_M(x)+P_M(y) = 0$. That is, $x+y \in l(M)$. Since l(M) is always a pencil, this implies that l(M) is a subspace.

Analagous to be concept of l(C), we define r (C).

Definition :

Let C be a pencil in X. We define

$$r(C) = \{x \in X: \|c\| \leq \|x+c\| \text{ for each } c \in C\} = \{x \in X: C \perp x\}. = \{x \in X: C \subset l(x)\}.$$

Remarks :

(1) r(c) is a pencil

(2) If C_1, C_2 are two pencils such that $C_1 C_2, \subseteq$ then $r(C_1) \supseteq r(C_2)$.

(3) If C_1, C_2 are pencils, then $r(C_1 \cup C_2) = r(C_1) \cap r(C_2)$.

(4) If $\{C_i\}$ $i \in \Gamma$ is a family of pencils, and if $C = \bigcup_{i\in\Gamma} C_i$, then $r(C) = \bigcap_{i\in\Gamma}(C_i)$

(5) If C is a pencil, then C = (r (l(C)$\cap$ l(r (C).

Theorem 2.5.

Let C be a pencil in X. Let $T = \cup\{B(x, 1):$ $x \in C$, $\|x\| = 1$, where B(x, 1) is the open ball of radius 1 centred at x}. Then

$$r(C) = \{y \in X: [y] \cap T = \phi\}.$$

Proof :

$y \in r(C) \Longleftrightarrow \|c\| \leq \|c-ty\|$ for all $c \in C$. $t \in R$,

$\Longleftrightarrow c\| \leq \|c-ty\|$ for all $c \in C$, with $\|c\| = 1$, and for all $t \in R$

$\Longleftrightarrow ty \notin B(c,1)$ for all $c \in C$, with $\|c\| = 1$, and for all $t \in R$

$\Longleftrightarrow [y] \cap T = \phi$.

□

R. C. James [3] has shown that, if dim X ≥ 3, then X is a Hilbert space if, and only if, '$\perp$' is symmetric. Using James' Theorem, we obtain the following characterization of a Hilbert space.

Theorem 2.6.

Let X be a Banach space with d(X) ≥ 3. Then X is a Hilbert space if, and only if, l(M) = r(M) for every closed subspace M of X.

Proof :

If X is a Hibert space, then '$\perp$' is symmetric, and it is immediate that r (M) = l(M) for every closed subspace M.

For the converse, let x, y $\in$ X, and let $x \perp y$. Then $x \in l(y)$. Since l([y]) = r([y], $x \in r([y])$. This means $y \in l([x])$. In other words $y \perp x$. Thus, by James' theorem, X is a Hilbert Space.

□

§§ 3 **Some example of l(c) and r(c)**

1. Let $X = \mathbb{R}^2$ with $\|(x, y)\| = |x| + |y|$. Let $M = \{(x,y) \in X : y = o\}$. Then $l(M) = \{x,y) \in X : x = 0\}$, and $r(M) = \{(x,y) \in X : |x| \leq |y|\}$.

2. Let $X = \mathbb{R}^2$ with $\|(x,y)\| = \max\{|x|, |y|\}$. Let $M = \{(x, y) \in X : y = 0\}$. Then $l(M) = \{x,y) \in X : |x| \leq |y|\}$ and $r(M) = \{(x.y) \in X : x=0\}$.

3 Let (T,Σ,μ) be a measure space, and let $X = L_1(T,\Sigma,\mu)$. Let $A \in \Sigma$, $B = T \setminus A$ such that $\mu)(A) \neq 0 \neq \mu(B)$. Let $C_A = \{f \in X : f \sim_A = 0\}$. Then C_A is chebyshev. $l(C_A) = \{g \in X : g \sim_B 0\}$ and $r(C_A) = \{g \in X : \|g \sim_B\| \leq \|g \sim_A\|\}$. In this example, $l(C_A) \subseteq r(C_A)$, $l(l(C_A)) = C_A$ and $r(r(C_A)) = \{0\}$.

Also, $l(r(C_A) = \{g \in X : \|g \sim_A\| \leq \|g \sim_B\|\} = r(l(C_A).)$

4. Let (T,Σ,μ) be a measure space, and let $X = L_\infty(T,\Sigma,\mu)$. Let $A \in \Sigma$, $B = T \setminus A$ such that $\mu(A) \neq 0 \neq \mu(B)$. Let $C_A \{f \in X : f \sim_A = 0\}$. Then C_A is proximinal. $l(C_A) = \{g \in X : \|g \sim_B\| \leq \|g \sim_A\|\}$ $r(C_A) = \} g \in X : g \sim_B = 0\}$.

5. Let $X = C(([0,1]))$, the Banach space of real-valued continuous functions on $[0, 1]$ with the supremum norm.

(a) Let A be a closed subset of $[0, 1]$, and let $B = [0, 1] \setminus A$.

Let $I_A = \{f \in X : f \sim_A = 0\}$.
Then $l(I_A) = \{f \in X : \|f\|_A = \|f\|\}$, and $r(I_A) = I_B$.

(b) Let P_n be the subset of $C([0, 1])$ of all polynomials of degree at most n. Then

$l(P_n) = \{f \in X$: f has atleast $n+2$ alternations, $0 \leq x_1 < x_2 < \cdots < x_{n+2} \leq 1$ such that $f(x_i) = (-1)^{i-1}\|f\|$, $i = 1\ 2, --, n+2\}$, and $r(P_1) = \{g \in X : g(0) = 0 = g(1)\}$ and $r(P_n) = \{0\}$ for $n > 1$.

Let ζ be the subspace of $C([0, 1])$ of all constant functions. Then $l(\zeta) = \{f \in X$: f has at least two alternations$\}$ and $r(\zeta) = \{g \in X : \min g(t) \leq 0 \leq \max g(t)\} = \{g \in X : g^{-1}(0) \neq \phi\}$

Hence $l(\xi) \subset r(\xi)$.

(6) Let $X = l_\infty$: Then c_o is a closed subspace of X.

$l(c_o) = \{x = (x_n) \in l_\infty$: either

(i) $|x_n| \neq \|x\|$ for each or

(ii) $\|x\| = |x_n|$ for infinitely many n's$\}$.
$r(c_o) = \{0\}$.

§ § 4. R.C. Buck [2] has given a representation for $l(M)$, where M is a closed subspace of X.

$l(M) = U\{W_f : f \in S_M^*\}$ where $S_M^* = \{f \in X^* : \|f\| = 1$, and $f(M) = 0\}$,
and where $W_f = \{x \in X : f(x) = \|x\|\}$.

In the same paper, R. C. Buck has also shown that $P_M(z) = M \cap (z + l(M)$ for every $z \in X$. We derive a similar representation for $r(M)$.

Let $D: X \to 2^{S(X^*)}$ be defined by $D(x) = \{f \in S(X^*) : f(x) = \|x\|\}$

Let $d: X \to S(X^*)$ be any selection for the map D.

Define $V_d^M = \bigcap_{y \in M} \ker d_y$

Theorem 4.1.

$r(M) = U\{V_d^M$: d a selection for the map D$\}$.

Proof :

Let $y \in r(M)$. Then $M \perp y$. Therefore $m \perp y$ for each $m \in M$. Let $m \in M$. There is $f_m \in S(X^*)$ such that $f_m(y)=0$ and $f_m(m) = \| m \|$. Therefore, $f_m \in D(m)$ and $y \in \ker f_m$. Thus, for each $m \in M$, we can find $f_m \in D(m)$ such that $y \in \ker f_m$. The map $m \to f_m$ is a selection of $D_{\dashv M}$, d (say). Then

$$y \in \bigcap_{m \in M} \ker f_m = V_d^M .$$

Hence $r(M) \subset \cup \{V_d^M :$ d a selection for the map D$\}$.

The other inclusion is obvious, and hence we have equality. ▭

Analogous to the metric projection P_M, we define a map Q_M as follows : $Q_M : X \to 2^M$ where,

$$Q_m(z) = \{m \in M : z\text{-}m \in r(M)\}$$

Note that, for $0 \neq z \in X$, $Q_M(z) = (z+r(M)) \cap M$.

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NITRATION OF AROMATIC COMPOUNDS USING UREA NITRATE-POLYPHOSPHORIC ACID

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Aromatic nitro compounds in good yields are prepared by nitrating the aromatic compounds with urea nitrate-polyphosphoric acid. In the present note an attempt is made to record a process evolued to nitrate aromatic compounds like methyl benzoate, naphthalene, p-nitrotoluene, benzaldehyde, chlorobenzene, benzoic acid, nitrobenzene, phthalic and phenol.

Aromatic nitro compounds were prepared using polyphoshoric acid and nitric acid (HNO_3-PPA) (1). This note describes the nitration of methyl benzoate, naphthalene, p-nitrotoluene, benzaldehyde, chlorobenzene, benzoic acid nitrobenzene, phthalic acid and phenol using urea nitrate-polyphoshoric acid mixture.

10 grams of phosphorous pentoxide was dissolved in 10 ml of orthophoshoric acid. This polyphosphoric acid was treated with urea nitrate (2) followed by the addition of the aromatic compound. During the course of the reaction the temperature was maintained between 0 to 5° C. The mixture was stirred well mechanically. The reaction mixture was heated slowly until a distinct yellow colour was developed. Then the reaction mixture was cooled well. On working up the reaction mixture, the nitro compounds were identified by mmp, elemental analysis, molecular weight by Rast's method, Co TLC and further confirmation was proved by superimposable I.R. Spectra with authentic samples.

Table I :

Substrate	Reagent for nitration	Condition for reaction Temp ° C	Time
Methyl benzoate (0.01 Mole)	Urea nitrate (0.01 Mole) + P P A	100	6 hrs
Naphthalene (0.01 Mole)	Urea nitrate (0.02 Moles) + P P A	40	1 hr
p-Nitrotoluene (0.01 Mole)	Urea nitrate (0.02 Moles) + P P A	100	1 hr
Benzaldehyde (0.01 Mole)	Urea nitrate (0.02 Moles) + P P A	100	6 hrs
Chlorobenzene (0.01 Mole)	Urea nitrate (0.02 Moles) + P P A	100	5 hrs
Benzoic acid (0.01 Mole)	Urea nitrate (0.02 Moles) + P P A	100	5 hrs
Nitrobenzene (0.01 Mole)	Urea nitrate (0.02 Moles) + P P A	100	6 hrs
Phthalic acid (0.01 Mole)	Uren nitrate (0.02 Moles) + P P A	100	6 hrs
Phenol (0.01 Mole)	Urea nitrate (0.02 Moles) + P P A	40	1 hr

Table 2

Compound obtained	YIELD %	M. P.°C	LIT.MP°C
Methyl m-nitrobenzate	60	78	78.5
1-Nitronaphthalene	58	59	61
2, 4-Dinitrotoluene	55	70	71
m-Nitrobenzaldehyde	55	56	58
2,4-Dinitrochlorobenzene	50	50	52
3,5-Dinitrobenzoic acid	60	205	207
m-Dinitrobenzene	58	89	89
3-Nitrophthalic acid	69	218	218
p-Nitophenol*	62	112	112

* Here the other siomer namely O-nitrophenol is removed from the mixture by steam distillation.

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Short Communication

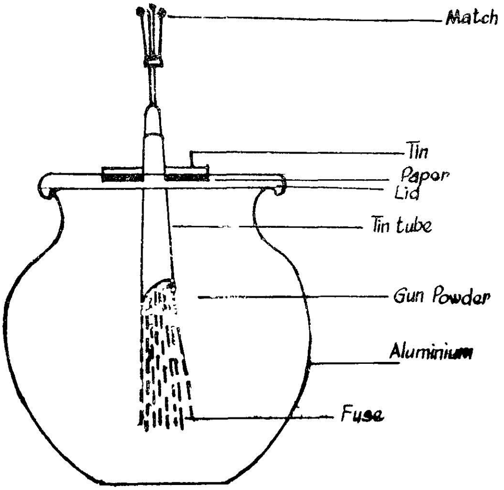
THE COUNTRY BOMB OF MADURAI

SYNOPSIS

Freedom Struggle in Madurai-Coronation ceremony - the country bomb placed contents - the TNT of the bomb.

On May 12, 1937 the Coronation Ceremony of King George VI was celebrated in the Tirumalai Nayak Palace of Madurai.[1] It created hot displeasure in the minds of the freedom fighters of Madurai that they decided to punish the mob who attended the function, both English and natives, and to carry out their aim they kept a country bomb in the Palace. The Police smelt the plot, removed the country bomb and avoided explosion.[2] Here the aim of this note is to shed enough light on that country bomb.

The bomb consisted of a beaten aluminimum chamber of one and a half pints capacity. The mouth was closed with a piece of tin firmly hammered over the edges. In the centre of the tin lid was a circular hole about an inch in diameter. Over this was glued several coloured paper strengthened in the middle with a small piece of tin sufficient to cover the circular opening. The piece of tin served as a holder for another cone shaped piece of tin through which was passed a long length of tangled and twisted thread to the end of the fuse was seemed a short length of 'scented stick' round which again were fastened three safety matches. The whole arrangement was wound round by a cotton thread. The matches formed the charges of the bomb.[3] The chamber contained two pounds of gun powder tightly packed along with which were thirty small pieces of broken pieces of thick soft drink bottle([4]).



The material in the bomb is calculated to be equivalent[5] to approximately 0.4 Kg. equivalent of TNT which is enough to cause substantial damage.

Foot Notes

1. *Special Report on discovery of country made bomb in Tirumalai Nayak Palace,* Public General Department, confidential, dated, 11-9-1927.
2. *Government Order* No 1747, confidential dated 31-5-1937, Despatch Abstract, Extract from the Fortnightly Report of the District Magistrate of Madurai.
3. Letter from Sri Charles B. Cunningham, Inspector General of Police, Madras to the Chief Secretary to the Government of Madras, Public Dept letter dated, 13 May 1937.
4. *Public General* (1937) *Dept.*, Miscellaneous Serious G.O. No. 1747, Confidential dated 11-9-1937. Bomb in Tirumalai Nayaks Palace.
5. Weast R. C., 1977 C.R.C. *Handbook of Chemistry and Physics,* C. R. C. Press, Ohio, 58th edition, pp. d 45-79.

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Book Review

TAMIL PUBLISHING IN THE NEXT DECADE (TAMIL) (An anthology of papers presented at the seminar on Tamil publishing held by the National Book Trust at Madras on November 1977) - ed. by, Athavan Sundaram, published by the Director, National Book Trust, India, 1978, 153p., Rs. 7.50.

As usual with all proceedings of Seminar papers the text opens with the editor's note with points to be discussed in the Seminar. The first paper by Vanamamalai on 'Tamil works on different sciences; at present and its Future' in which he examines the growing rate of literacy streses the responsiblity of the writers in contributing works to meet with the mounting demand. The paper sheds light on subjects of common interest in Tamil and also its expansion towards micro-biology, spacebiology, molecular-biology, bio-physics, bio-chemistry and insists on the storm speed in producement of new scientific works. However the Tamil interest in reading the Marxist literature is illustrated with empirical studies. Gorky of Russia is compared with Bharathi in Tamil. Suggestions are to create philosphical books in small forms with different titles such as Indian Philosophy, World Philosophers is useful. The appeal of the author is to publish the manuscripts of miscellaneous subjects in abundance by the Universities

Tillainayagam in his paper 'The publication of Tamil works and the service of Tamil libraries' traces the evolution of libraries and their role. When stating the purpose of the libraries the author attributes that libraries are devoted to education, economics and preservation of antiquities The acquaintance of libraries to the publishers, statistics of publications and the condition at present, are very well illustrated. The paper is instructive as it gives the literary index symbols such as 'P' for Linguistics, 'Q' for Religion, 'R' for Philosophy, 'T' for Education, 'U' for Geography, 'V' for History, etc. He adds light to six types of books such as crown (1×8), demy (1×6) etc. Morever this paper sheds much light on Publishing Houses, Authors, quality of works, price, etc. and his paper is an instructive one for writers and publishers.

'The best sellers in Tamil and their Authors', the third paper by M. R. Rangarajan comments on the taste of Tamil readers that it is the same and there has been no significant change in the near past. He produces acceptable accounts on novels and deductive novels. He induces the publishers not only to stick to the popular taste but advocates to select the right personality as well. His survey on folk literature, religious texts and fictions are interesting.

The analysis of Vanathi Tirunavukkarasu in the fourth paper, 'Low Priced Edition in Tamil-yesterday, today and in future' is bringing forth the scope of wider selling with low price. Therefore the most scholarly text can also reach the poorest people and it would be a good service. The author extends his gratitude to such publisheres who have done this service and in this connection his tribute to Lifco is consistent.

The next paper on 'Sales and Distribution' by K. A. Chellappan describes the chances for sale. In his evaluation the distributing agencies are unsatisfactory. He feels that distributing agency should find a scattered space and should be maintained in a proper order. He suggests the Government to print books in good quality and export them.

An author is experiencing 'closed doors' of the publishers, in the past this was the experience of Asokamitran as well. He indicates the neglect of publishers even to read the manuscripts given by the budding scholars. His paper, 'The problems of

writers' sheds light on such difficulties experienced by writers in producing books.

Lakshmi Narasimhamurthy insists on the purpose of a well-finished text with good lettering, wrapper, soft binding and end-paper to appeal to those who read that book.

Economy in Tamil Books Production and for which the cheap cost of production and Price fixation in a way beneficial for Writer and Publishers is stated by T.V S. Mani. V.S. Krishnamoorthy evaluates the better Printing and the Prospects. He is furnishing fresh light on speedy book Printing with computers and photo composing and inspires to carry the work with a co-operative endeavour.

C. Kangaga sababathy's Paper on 'Department of Academic Publishing in Tamil', traces the evolution and growth of text books ever since 1812. Publications to him, fall under different forms such as text books, encylopedias, dictionaries, historical texts etc. His approach to Academic institutions from their point to libraries, newspapers, writers etc. provokes considerable interest.

'Translated Publications' by Rudra Tulasidas is a commendable paper that it speaks of the Practical Problems involved in translations. The author cites the example of acids or any other chemicals for that matter, when one sticks to the grammar of the language. The author says that in the practical life, officials who commit the errors such as 'Periyar Minor Irrigation Project' as 'Periyar Siruneer Pasana thittam' and an usage such as 'the prepared hydrogen is collected through the delivery tube' into 'uruvakkappatta hydrogen, Pirasava Kulai valiyaca Sekarikkappatukirathu' etc. He states linguists can act more liberally for common understanding when they translate passages. Pakkiyamuthu in the next paper encourages those publishers to publish atleast one novel a month. He insists that newspapers should take interest in reviewing such novels as they at Present take interest in reviewing films.

'Tamil Writers' Co-operative society-past, a glance at the present, and suggestions for future' is the paper of Rajam Krishnan and it discusses the role of elites and their responsiblity in producing standard texts. The author rejects the criticism of the Tamil Writers' Co-operative Society that it always publishes the Writings of educationalists only. The author insists that in future the Tamil Writers' Co-operative Society would render its services to evolve a new taste in book studies. L. Ramakrishnan limelights the difficulties with the Publishers and feels that they do it just for experimentation in publishing. Thampi Sreenivasan evaluates the standrard of the produced texts and tries to evolve some guidelines for future.

As a compendium of several papers, the treatise edited by Aathavan Sundaram describes the past, present and the future of printing as well as publishing in Tamil.

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Instructions to the Authors

Manuscripts intended for publication in this journal should be in English, typed on one side of bond paper and double spaced with 5 cm. margin all around and sent in duplicate to the Editor. The length of the article should not exceed 15 typed pages and should be accompanied by a brief abstract in the form acceptable to abstracting journals. Also the title of the article should be condensed into " Key words " and sent along with the article, *Foot-notes will not be accepted* Words to be printed in italics or bold face should be underlined in the manuscript. The manuscript will be underlined in the manuscript. The manuscript will be refereed (authors may indicate referees if they wish) Publication of an article is subject to the opinion of the referees and the decision of the Editor. Authors will be solely responsible for the views expressed by them. 25 reprints will be supplied free for every article. Extra reprints if needed will be supplied but the authors will be charged for the same.

Humanities

All quotations should correspond exactly to originals in wording, spelling, punctuation and paragraphing. Omissions with a quotation may be indicated by spaced periods. References in the text should give the name of the author followed by a comma, the year of publication within brackets thus: Stewart, (1917) or they may be followed by raised Arabic Numerals in order at the point of reference in the text thus, 1, 2, 3,. Separate list of references cited in the text should be given in alphabetical order at the end of the paper thus:

Lushington, S. R. 1799. Board of Revenue 21 Aug, 1799. Board of Revenue Consultations. 231 : 6903 - 4.

Stewart, J. A. 1917 : " Cambridge Platonists " *Encyclopaedis of Religion and Ethics*. ed. J. Hastings. Charles scribner's Sons, New York. III, P. 69.

Sciences

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Hastler, A. D 1966. *Underwater guideposts Homing of Salmon*. Univ. Wisconsin Press, Madison, U. S. A. 155 pp.

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